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TABLE OF CONTENTS.

ENGINEERING NEWS OF THE WEEK..... 553, 556
A Proposed New Type of Dam (*illustrated*)..... 554
Shop Notes in Paterson, N. J..... 554
Brooks Locomotive for the "Exposition Flyer"; Lake Shore & Michigan Southern Ry. (*illustrated*). 555
Water-Works Intakes on Lake Michigan..... 555
Frankfort Terminals and Boats for the Toledo, Ann Arbor & North Michigan Ry. Co.'s 63-Mile Transfer (*with inset*)..... 556
World's Columbian Exposition—XIV.; Baldwin and Brooks Locomotive Exhibits (*illustrated*) ... 558
Harlem River Drawbridge; New York Central & Hudson River R. R. (*illustrated*)..... 559
The Works of the East Jersey Water Co. for the Supply of Newark, N. J..... 560
Steam Shovels and Steam Shovel Work (*continued*). 560
A New Form of Brake Gear (*illustrated*)..... 562
Heavy Express Compound Locomotive; Chicago, Milwaukee & St. Paul Ry. (*illustrated*)..... 567
The Relations of Track to Train Service (*illustrated*)..... 567
The 54-in. Steel Submerged Pipe for the Syracuse Water-Works..... 569
The Western Railway Club's Tests of M. C. B. Couplers..... 569
The Trolley on the Erie Canal..... 570
PERSONALS, NEW PUBLICATIONS, SOCIETY PROCEEDINGS..... 562, 563
EDITORIAL NOTES..... 564
Relations of Track to Train Service—Resignation of the New York Rapid Transit Commissioners—Riot on the Chicago Drainage Canal.
EDITORIALS:
Air Brakes in the Lafayette Accident..... 564
The Ideal Engineering School—VI..... 565
LETTERS TO THE EDITOR..... 566
The Law of Unequal Foundation Loads—Strength of Steel Columns; Correction.
CONSTRUCTION NEWS..... 570, 573
Railways, Street Railways, Elevated and, Cable Railways, Highways, Bridges, Tunnels and Canals, Water-Works, Artesian Wells, Irrigation, Sewers, Streets, Electric Light and Power, Contract Prices, Miscellaneous.
INDUSTRIAL NOTES..... 573

The locomotives on the Japanese railways number 206, of which 200 were built by English locomotive works, 4 by the Esslingen works in Germany, and 2 by the Baldwin Locomotive Works, Philadelphia, Pa. There are no less than 24 classes, of which 16 are tank engines, and one has engine tanks as well as a tender. There are four classes of eight-wheel engines, all with four-wheel tenders, and two classes of moguls. The two Baldwin engines are of the mogul type, with six-wheel tenders, the rear of the tender having a four-wheel truck. The four German engines are tank engines, with six wheels, all coupled, and fitted with gear wheels on the Abt system for working a steep grade laid with Abt rack rails.

The Central Indiana Electric Ry. Co. has been incorporated with $4,500,000 capital stock, with J. T. Baker as president. The central point of the proposed system of lines is Noblesville, 20 miles north of Indianapolis. From this point it is proposed to run lines aggregating in length 300 miles of main track, to the principal cities of the Indiana gas belt, with a double-track line from Noblesville to Indianapolis. This is probably the longest system of electric railways yet projected in this country. Further particulars are given in our news columns.

The Jirardot Railway, in the United States of Colombia, is to be extended. Mr. George A. Schele, Chief Engineer; Mr. J. C. Gobner, Chief of Construction, and Colonel Pennington, the concessionnaire, have recently arrived in that country from New York to undertake the preliminary arrangements for construction. The road is to be 75 miles long, of which 24 miles are already built, but the arrangements for its completion have only recently been made by the government.

The new drawbridge at the locks of the Louisville & Portland Canal, near 27th St., Louisville, Ky., will be a steel structure with pin-connected Pratt trusses, having a single intersection of ties. The total length will be 189 ft. 3 11-16 ins. c. to c. of end pins, with a center panel 14 ft. 3 11-16 ins., and five panels on each side 17 ft. 6 ins. The height of truss will be 20 to 25 ft. The bridge will be 18 ft. wide, c. to c. of trusses, with a clear headway of 14 ft. from floor to portal bracing. The floor system will consist of seven lines of 10-in. I-beam stringers resting on the floor beams; on these will be oak raising strips 3 x 5 ins., and oak flooring planks 4 x 12 ins. For dead load the weight of iron is to be assumed at 10.3 lbs. for 12 cu. ins., and 2% heavier for steel; oak, 4½ lbs. per ft. B. M. The live load is to be 100 lbs. per sq. ft. for a 17-ft. floor, or 1,700 lbs. per lin. ft. of bridge, or a 15-ton steam road roller. The bridge will be erected open, or parallel with the canal, the falsework resting upon the masonry walls of the locks. Bids will be received until June 21. Lieut.-Col. G. J. Lydecker, U. S. Engineer Office, Louisville, Ky., is in charge of the work.

The Croton Aqueduct Commissioners have resolved to build a large storage reservoir within the city limits and north of the Harlem River. The reservoir may be located in Jerome Park, where a structure with an available storage capacity of 1,500,000,000 gallons could be built.

When the Bangor Electric Ry. Co., of Bangor, Me., first attempted the use of water power for generating the current, it was very much inconvenienced by the inability of the mechanical governor to regulate the quantity of water on the wheel with sufficient promptness to respond to the great variation in power caused by the stopping and starting of the cars; but the engineers have so nearly regulated this difficulty that for all practical purposes the plant is running as well by water as it was at first by steam.

Submarine borings on the outer Diamond Shoals, for the Cape Hatteras lighthouse, are authorized by the Lighthouse Board, to the extent of $5,000. The object is to find solid bottom on which to build, an appropriation of $300,000 being yet available for a lighthouse at this point. A little of this work done just previous to last year's attempt to found a caisson there would probably have saved the contractors, Messrs. Anderson & Barr, about $70,000 lost at that time by heavy seas, shifting sands and a faulty chart of soundings furnished by the government.

The most serious railway accident of the week was the derailment June 8 of a passenger train on the New York, Lake Erie & Western R. R., at Jamestown, N. Y. The accident was caused by a stone wedged in the flangeway at a road crossing. The engine, baggage car and express car were badly wrecked and three men were seriously injured.

The St. Louis & Southwestern R. R. bridge over Duncan Creek, ten miles from Athens, Tex., gave way under an accommodation train June 6, and five persons were injured. A railway bridge at Creston, Ia., was burned June 6. The principal bridges washed away by the recent flood in Crawford county, Pa., are the Mercer St. iron bridge, 225 ft. long, in Meadville; the Broadford bridge, between Saegertown and Venango, a wooden structure 233 ft. long, and the covered bridge at Venango, 249 ft. long, all on French Creek. The Conneautville bridge and McCobb bridge in South Shenango are also gone.

The State dam in the Hudson River, at Troy, N. Y., was broken June 12, nearly 60 ft. being carried away, causing the suspension of navigation on the Champlain Canal, and affecting many industries along the riverside. It is said that millowners have for some time complained of the condition of the dam. It was inspected last autumn.

The Page mill dam, at Fergus Falls, Minn., gave way June 1, and the rush of water carried away the north end of the dam of the City Power Co., a mile below. Three other dams, of the series of five reservoirs, were left uninjured. The power company furnished power and water for the city water-works, which were thus left without power.

The coal trestle of the Philadelphia & Reading R. R. at Cheektowaga, near Buffalo, N. Y., was destroyed by fire June 9, causing a loss of nearly $500,000. The structure was of iron and wood, built three years ago at a cost of $250,000 to $300,000, and was completely destroyed, together with about 60,000 tons of coal.

The city of Philadelphia has just awarded the contract for two 30,000,000-gallon vertical triple compound pumping engines to the Holly Manufacturing Co., of Lockport, N. Y., for $162,570. The engines will be placed at the Spring Garden pumping station, and will be completed one within 12 and the other within 15 months. The engines are guaranteed to perform a test duty of 125,000,000-ft. lbs.

An international maritime congress, the second meeting of a like nature, is to be held in London in the rooms of the Institution of Civil Engineers on July 18 to 21. The objects of this congress are as as follows: The reading and discussion of papers concerning ports, harbors, breakwaters, docks and their equipment, shipbuilding, lighthouses, etc. The first meeting was held in Paris in 1889, and 22 papers were presented and some of the most important seaports of the North and West of France were visited. Lord Brassey is the president of this second congress, Mr. L. F. Vernon-Harcourt is the vice-chairman, and Mr. James Forrest is the honorary secretary. The list of papers include 15 upon harbors and breakwaters; 11 upon docks and their equipment; 6 upon shipbuilding, marine engines, etc.; and 10 upon lighthouses, their illumination, electrical connection with the shore, and fog signals. Any one interested may become a member of this second congress for the London meeting by the payment of £1 forwarded to the Secretary of the International Maritime Congress, London, England. The card of membership will entitle the holder to take part in the proceedings of the congress and join in all visits and excursions.

A bridge across the Mersey, to connect Liverpool with Birkenhead, is proposed, as neither the ferry steamers nor the Mersey Tunnel Ry. afford the facilities required for road traffic. The proposed structure is of the arched suspension type, with three spans of 1,100 ft., involving only two river piers. The headway of the center span is to be 150 ft. at high water. The approaches would have a grade of 2.8% on the Liverpool side, and a flatter grade on the Birkenhead side. The bridge would have a 40-ft. roadway, and two sidewalks 7 ft. 6 ins. wide, which dimensions seem unnecessarily narrow, and the sidewalks especially would be very inconvenient promenades. An upper floor for street cars is proposed. Near the shore line powerful elevators would be provided to accommodate wagons and teams along the dock front. The published plans show arches rising from the water line to a considerable height above the floor, which is thus partly suspended from the chords and partly supported by posts resting upon them. The cost is estimated at $8,650,000. The engineers are J. J. Webster and J. T. Wood.

The Central Peruvian Railway has been extended to Oroya, 30 miles east of the summit of the Andes and the originally intended terminus of the road. Oroya is 136 miles from Callao, and on this line are thirteen stations, ten bridges, two tunnels and four "switchbacks." Five of the stations are over 10,000 ft. above the sea level; and one is 13,420 ft., and another 13,606 ft. above the sea. There is a tunnel at an elevation of 15,665 ft., two bridges at over 11,000 ft., and a "switchback" at 12,697 ft. above the sea-level. Oroya, says the British Consul at Callao, is destined soon to be a commercial center of considerable importance. Smelting works have been started at Casapalca and other adjacent places, and it is hoped that the railway will be extended, by way of Tarma and Chanchamayo, to the head of navigation on the Amazonian River system.

The big wheel-pit for the Niagara Falls Power Company is nearly completed. This pit is 200 ft. deep, 100 ft. long and 20 ft. wide, and will be fitted with the appliances for four 5,000-HP. wheels. This is the first of eight pits of equal size included in the plans. A smaller wheel-pit for the Niagara Falls Paper Company was finished last week.

The International Navigation Company, with $15,000,000 capital, was incorporated at Trenton, N. J., on June 7. The list of incorporators include a number of persons connected with the Pennsylvania Railway Co.; among them are Messrs. A. J. Cassatt, H. H. Houston, Clement R. Griswold, W. H. Barnes and Joseph D. Potts. The object of the company is the transportation of freight and merchandise by steam and other vessels.

The Boston rapid transit bill has passed the Massachusetts Legislature by a vote of 104 to 85, and is ordered to be engrossed. The bill has been very materially amended, and, according to the Boston "Herald," much mutilated. The good amendments put the appointment of the three commissioners into the hands of the Supreme Court, instead of leaving this with the Governor, and call for a vote of the citizens before the law goes into effect. The commissioners are now allowed to put tracks on Washington and Tremont streets and Shawmut Avenue, routes forbidden in the original bill; but they are prohibited from taking any part of the Common. The chief other amendments give abutters the right to incidental and consequential damages, and permit any transportation company to use the roadbed when completed. The provisions of the original bill yet remaining in force provide that a commission of three members, at $6,000 per year each, shall investigate and determine upon the necessities for rapid transit in Boston and its suburbs; lay out certain streets named and widen others and provide for a bridge over the Charles River. This commission is given the power to take land in the city and to go through private property by purchase or otherwise; subways may be built for the street railways, but no surface road is to be permitted on the route designated. The right to build the road is to be sold to the highest bidding corporation, and money is to be raised by the city of Boston by the issue of 30-year bonds at not more than 6%. The state is also authorized to issue bonds to an amount not exceeding $15,000,000, as a loan to the city of Boston. Provision is made to repay the state. The bill in its present shape seems to give much dissatisfaction, especially to other municipalities taxed for Boston rapid transit. Its opponents feel that the bill is now so harmless and so guarded that no one could build under it.

A PROPOSED NEW TYPE OF DAM.

The Arrowhead Reservoir Co., of San Bernardino, Cal., is constructing a system of irrigation works to supply water to land in the region north and west of San Bernardino. As planned, four reservoirs are proposed on branches of the Mojave River. Plans for the works were prepared some time ago by a board of engineers composed of Messrs. Jas. D. Schuyler, M. Am. Soc. C. E., Frank Perris, Chief Engineer of the Pacific Division of the Atchison, Topeka & Santa Fe R. R. Co.; A. H. Koebig, Chief Engineer of the Arrowhead Reservoir Co., and Mr. Latham Anderson, M. Am. Soc. C. E. Mr. Anderson proposed a new type of dam for the Little Bear Valley reservoir,

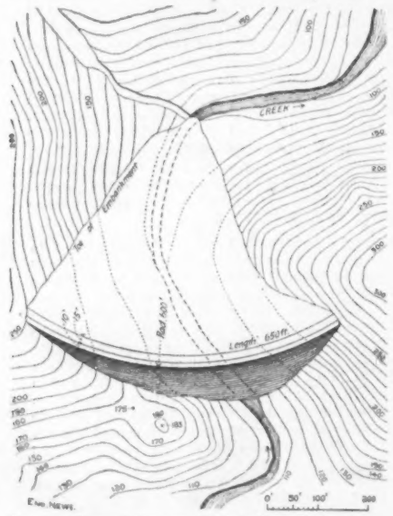


Fig. 1. Plan of Proposed Little Bear Valley Dam.

but the other members of the board considered it too novel for so large a structure and a solid masonry dam is being built instead.

Fig. 1 is a plan of the dam as proposed, and Fig. 2 a cross-section of it. The following description of the design is from a paper read by Mr. Anderson last year before the Engineers' Club of Cincinnati:

In view of the frequent earthquakes in this part of the continent (Southern California) the writer considered it unadvisable, if not unsafe, to rely on a purely masonry structure. But, for reasons already given, an earthen dam could not be economically constructed here. To meet these conditions the following type of dam was proposed by the writer: The water face of the dam to have a face of masonry on a slope of ½ to 1 of a uniform thickness, to act as a retaining wall when the reservoir is empty. The thickness calculated for a dam 150 ft. high is 10 ft. (In the plan submitted to the consulting board a thickness of 14 ft. was proposed.) This masonry is to have a dry wall backing 2 ft. thick, with the joints well filled with cement mortar 3 or 4 ins. from the lower face. A tile underdrain is extended along the bottom of this wall, with outlets under and across the dam, and discharging below its foot at regular intervals of height. The dry wall thus acts as a drain to the masonry above. As shown on the section, Fig. 2, this composite masonry wall rests upon

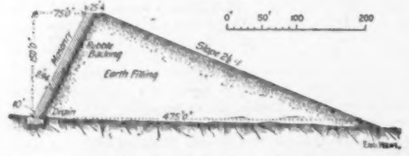


Fig. 2. Cross-Section of Proposed New Type of Dam.

an earthen dam. Instead of being spread in layers in either of the usual methods, the earth, granite bowlders and gravel are to be piped into place by the hydraulic method. The wall is first carried up as high as it can be safely built on this slope without support. When a section of the wall is finished to this height the earth backing is filled in to within a few inches of the top of the wall. Another section of the wall is then built, and another layer of earth filling piped in; this process being carried on to as high a level as it is practicable to pipe in the earth. It is expected that we would be able to construct the dam in this manner to a height of 125 or 130 ft., above which level the earth filling would be made of the same material as below, but deposited in one of the usual manners; probably in this case with wire rope and trolleys. The lower slope would be kept in shape by dry stone facing, carried up as the piping proceeds. The writer has found by experience that it is entirely practicable to control the shape by the hydraulic pumps in this way.

The object of pointing the lower side of the dry wall backing, while it is being deposited and after the wall is finished, is to prevent seepage water descending through the dry stone backing from washing the face of the earth beneath. The permeability of the drainage wall will thus be always maintained. Water always drains from earth filling of this gravelly character quickly, after which there is no settlement of the mass whatever. Therefore, there is no danger of the earth in this case settling and letting down the superincumbent walls. With water convenient, under good working head, the earth can be filled in at from 4 to 5 cts. per cu. yd.; the upper portion to be filled in by cable will probably cost from 20 to 25 cts. It is proposed that the wall shall be of concrete filled in with large blocks of granite, the joints in no case being less than 2 ins. thick. The facing, 2 to 3 ft. thick, is to be of large blocks of granite rubble, laid in cement with ¾-in. joints. The material, including blocks of stone weighing 4 to 5 tons each, is to be distributed on the wall by wire rope and trolley. This method of construction is employed successfully and with great economy by Mr. Schuyler at the Hemet Dam, near San Jacinto, Cal. There it is considered safe to build the dam entirely of masonry, owing to the peculiar advantages of the site. The canyon has bare rock walls so nearly vertical that the dam is only 50 ft. long on the bottom, and less than 200 ft. at a height of 125 ft. The thickness of the Hemet dam on the bottom is over 90 ft. It has a slightly arched form in plan. Its total height is to be 150 ft. The upper 25 ft. traverses a long granite ridge after leaving the canyon.

The amount of water impounded by the Hemet dam at a height of 150 ft. is 8,500,000,000 gallons; at 160 ft. it would be about 13,000,000,000 gallons. At 150 ft. in height the Little Bear Valley dam will impound about 25,000,000,000 gallons. The other three dams of the Arrowhead Co. have much less storage capacity than the Little Bear.

The floods are often so great in this valley, especially when the snows melt in April and May, that it is impracticable to catch all the storm water. Therefore the impounding capacity of the system will be measured by that of the main receiving canals. These are, therefore, designed to have a capacity of 30,000 miner's inches, or 600 cu. ft. per sec. With all four reservoirs filled to the contemplated height the system will have a total storage capacity of 15,000 miner's inches for two years, which is considered sufficient to provide for two successive years of extreme drought.

The type of dam above described was not adopted by the board of consulting engineers, as it was considered too novel and experimental in design.

The writer wishes to state with emphasis that this description of dam is not recommended for general adoption. This type is indicated only under the following conditions:

(1) Where the gorge is narrow and deep.

(2) Where the filling is so gravelly in character that when deposited in water and then thoroughly drained it at once shrinks to its ultimate minimum volume. With ordinary earth, which takes some time to settle, this construction would be inadmissible, because the embankment would settle away from the wall, and thus weaken it.

(3) Where the conditions are favorable to the use of the hydraulic method of filling in the earth backing.

The minimum thickness of wall permissible in this form of dam is that required to insure its stability as a retaining wall when the reservoir is empty. To provide ample security against earthquake shocks a thickness of 14 ft. was assumed in the plan, as at first proposed to the board of consulting engineers. Subsequently, calculations were made for the stability of a wall 10 ft. thick (measured horizontally), and it was found that the resultant between the earth pressure and the weight of the wall fell in rear of the foot of the latter. This, in connection with the curved form of the wall, and the stable, unyielding character of the gravelly filling deposited in water, insures, in the opinion of the writer, the safety of this type of dam as against earthquakes.

The factors against overturning and sliding of the entire dam are, of course, excessive.

SHOP NOTES IN PATERSON, N. J.

The aggregate value of the iron and steel and foundry and machine shop products of the city of Paterson, N. J., was, in 1890, a little over $6,000,000, and nearly three times as great as that of its textile products, principally silk, for which the city is widely known, although it is probably more familiar to our readers for its locomotive works. That the city owes its industrial prominence largely to its water power and its excellent transportation facilities by railway and canal is evidenced in the most cursory visit. The following brief notes of interest to engineers were obtained in a recent hasty visit to some of the principal manufacturing establishments:

Passaic Rolling Mill Co.—The transition from wrought iron to soft and medium steel for structural work is forcibly illustrated by a visit to the shops of the Passaic Rolling Mill Co. This company, which formerly produced little but wrought iron, now manufactures nothing but soft steel unless iron is demanded by the specifications, and even in this case an attempt is usually made to secure permission to substitute steel for the iron specified. The works of the company are located directly on the line of the New York, Lake Erie & Western R. R., and are equipped to turn out the heaviest kinds of structural shapes, including plates, angles, channels, I-beams, tees, all kinds of bar iron, and also irregular shapes when demanded. Very little attention is paid to the lighter class of bridge and other structural work. At present work is being concentrated on the heavy steel work for the McComb's Dam bridge, already briefly described in these columns (Eng. News, May 26, 1892), and on all sides are seen the heavy plates and angles undergoing the finishing processes. In some respects the size of these separate members better indicates the great weight of the proposed swing span than will the completed structure itself. Particularly noticeable are the girders for the turntable, 8 ft. deep and weighing nearly 21½ tons each, and the 10 × 1½ ins. eyebars measuring 23 ins. across the head. At this point it is interesting to note the changes which have taken place in the specifications for rivet holes within the past few years. A decade ago punched holes were the rule and reamed or drilled holes the exception. This is rapidly changing and now very few specifications call for punched holes unless they are to be reamed afterward. To accommodate this change the company has been compelled to considerably enlarge and improve its drilling plant. The mills are well equipped with labor-saving devices for handling material, bridge cranes operated by hand being used for the lighter weights, and hydraulic pillar cranes for handling the hot ingots and ladles. It should also be stated that fuel gas is used in both the open-hearth and puddle furnaces, there being 28 producers in all.

Cooke Locomotive & Machine Co.—The shops of this company, formerly the Danforth Locomotive & Machine Co., are located about a mile south of the Passaic Rolling Mills, and may appropriately be mentioned in the same connection, since the ownership of the two is practically common. A trip through the various shops exhibits a busy scene, about 30 locomotives of all classes being under way. The number of bridge cranes used is noticeable and there are few places where the peculiar advantages of this device are more evident than in a locomotive erecting shop or boiler shop. All of these cranes are operated from shafting. A striking fact brought out even in the most hasty visit is the great adaptability of compressed air power to certain classes of work in locomotive boiler construction which a decade ago was done by hand. With the small and compact pneumatic calkers, drills and shears attached to flexible tubes one workman rapidly and accurately does work which several could hardly accomplish in a less satisfactory manner without their use.

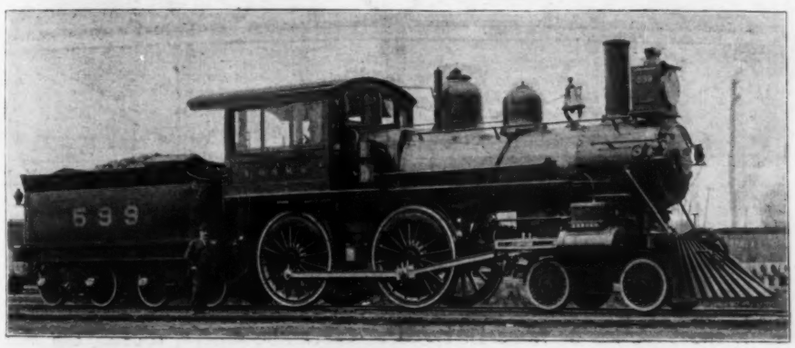
Rogers Locomotive Co.—The works of this company are located just west of the center of the city and connect with all three of the railways entering the town. Plenty of work is the feature of the day, as in most locomotive works, thanks to the great demand of the World's Columbian Exposition traffic. About 70 locomotives of all kinds are now booked or under construction. Among these may be mentioned eight 6-wheel switching locomotives destined for Chili and a two cylinder compound 10-wheel locomotive for Jamaica.

Riverside Bridge & Iron Works.—The increasing use of iron and steel in building construction is rapidly developing this class of work into a specialty with certain manufacturers. The Riverside Bridge & Iron Works now give their attention exclusively to architectural iron-work, and the weight and quality of much of this is somewhat surpris-

ing to one who has not closely followed the rapid advance in this class of structural work. By this is not meant the heavy roof trusses, etc., for train-sheds and similar structures, but the usual iron-work demanded in modern business and office buildings. Of the recent work of this company may be mentioned the Seventy-first Regiment Armory, in New York city. A novel feature of the iron-work for this building is the use of three-hinged arch trusses of 150 ft. span for supporting the main drillroom floor. These arches are arranged in pairs connected by lateral bracing and support a floor of I-beams filled between with brick arches. The arches are unusually heavy to resist the shocks produced by the marching infantry. The roof trusses of this building have a span of 190 ft. The company is now engaged upon the steel caissons which are being sunk by Sooysmith & Co. for the foundations of the Manhattan Life Insurance Co.'s new 16-story building on lower Broadway, in New York city. These caissons are being sunk by the pneumatic process and some of them will strike bedrock 24 ft. below the water level. This is, we believe, the first instance in which pneumatic caissons have been used for such a purpose, and their successful sinking will solve a problem which has long bothered contractors for foundation work in this section of the city. We hope to describe this work at length in a future issue.

BROOKS LOCOMOTIVE FOR THE "EXPOSITION FLYER"; LAKE SHORE & MICHIGAN SOUTHERN RY.

The "Exposition Flyer," or 20-hour train, between New York and Chicago, is now running in regular daily service each way, and is an interesting example of long-distance high-speed express train service. Its run is 980 miles in 20 hours. The train consists of four through cars, specially



EIGHT-WHEEL ENGINE FOR THE "EXPOSITION FLYER;" LAKE SHORE & MICHIGAN SOUTHERN RY.
Brooks Locomotive Works, Dunkirk, N. Y., Builders.

built by the Wagner Palace Car Co., and weighing 80,000 lbs. each, the weight of train therefore being 320,000 lbs., or 400,000 lbs. with dining car attached on certain portions of the run. The train is hauled throughout by engines of the eight-wheel type. The class of engine used on the New York Central & Hudson River R. R. was illustrated and described in our issue of May 18, the engines being built by the railway company. The class of engine used on the Lake Shore & Michigan Southern Ry. is illustrated and described herewith, and five of these engines have been built this year by the Brooks Locomotive Works, of Dunkirk, N. Y., to whom we are indebted for photographs and drawings. The drawings we shall publish in a later issue. It is reported that one of these engines ran 10.2 miles in less than six minutes, or at the rate of over 102 miles per hour. This speed was attained near Elkhart, Ind.

The engines are simple, designed for burning bituminous coal, and are considerably lighter than the engines of the New York Central R. R., but have been found fully equal to the work. The boiler is of the improved wagon-top Belpaire type, with conical connection, and having the dome on the connection sheet. The longitudinal seams are quardruple lap, without welt, and the circumferential seams are double lap. The firebox crown-sheet is arched 1½ ins. laterally in the center, and the firebox has a brick arch, carried on three 2½ in. water tubes. There are two Richardson safety valves, one plain and one muffled. The extension front has a deflector in front of the high double exhaust pipe. The smokestack is of cast iron, straight, and 16 ins. diameter. The grates have cast iron rocking bars. The cylinders have Dunbar packing, and Jerome metallic packing is used for piston rod and valve stem packing. The slide valves are of the Allen-Richardson pattern, with Allen port ⅞ × 16 ins. The reversing lever is of the multiple latch pattern, patented by Mr. Player, of the Brooks Locomotive Works.

The driving wheels are 6 ft. diameter, with centers 5 ft. 6 ins. diameter and Midvale steel tires secured by Mansell retaining rings, as illustrated in our issue of March 21, 1891. The driving and truck axles are of hammered iron. The connecting rods are of hammered iron, and are fitted with straps and keys. The coupling rods are of Midvale steel, and fitted with brass bushings. Both rods are fluted. The crankpins are of Midvale steel. The frames are forged solid, 3¾ × 4½ ins., 3 ft. 10 ins. c. to c., the back end dropped down 5 ins. to accommodate the standard tender. The frame pedestal ties are Mr. Player's patent. The engine truck has a swiveling spherical center, and is fitted with 33-in. Allen paper wheels. The Detroit springs are used on driving and truck axles, and the driving spring rigging is equalized, with auxiliary springs under the rear spring hangers. The oil cups of the rods have adjustable spindle feed; those on the eccentries are fitted with swab cups top and bottom, and those of the guides, etc., have adjustable screw feeds. The feed is supplied by two No. 8 Monitor injectors. The cab is of ash, with three windows on each side, the front stationary and the middle and back to slide. The headlight, lamps and steam heating apparatus are of the railway company's standards. The pilot is fitted with a shackle bar. The Westinghouse driver, tender and train brake is used, and also the Westinghouse train signal.

The tender has a frame of 10-in. steel channels, with a tank of 3-16 and ¼-in. steel. The trucks are of the diamond pattern with steel I-beam bolster and 36-in. Allen paper wheels. The axles are of hammered iron with journals 4 × 7 ins. The Gould coupler and buffer is used. Water is taken from the track tanks by a water scoop of the improved Ramsbottom pattern. The general dimensions and particulars of these fine express engines are given in the following table:

Running Gear.	
Driving wheels, diam (Mansell ret. rings).	6 ft. 0 ins.
Truck " " (Allen paper)	2 " 9 "
Tender " " "	3 " 0 "
Engine truck	Rigid center
Journals, driving axles	7½ × 9 ins.
" truck axles	5 × 10 "
" tender axles	4 × 7 "
Crank pins, main	4½ × 6 ins.
" " " coupling	5¼ × 4 "
" " " wheel fit	5⅝ × 7 "
" " back	3½ × 4 "
" " " wheel fit	4 × 7 "
Wheel Base.—Driving	9 ft. 0 ins.
Truck	5 " 9 "
Total engine	23 " 9 "
" tender	15 " 0 "
" engine and tender	45 " 8 "
Center of truck pin to center of leading driver	12 " 3 "
Weight in working order; on drivers (33,100 lbs. a main)	65,100 lbs.
On truck wheels	39,500 "
Engine, total	104,600 "
Tender, "	70,000 "
Engine and tender, loaded	174,600 "
Cylinders	17 × 24 ins.
Distance center to center	7 ft. 0 ins.
Piston rod, diam	3¼ ins.
Form of crosshead and guides	Four-bar
Connecting rod, length between centers	8 ft. 3 ins.
Valve Gear.—Type	Link
Ports; length, 16 ins.; width steam, 1⅝ ins.; width exhaust, 3 ins.	
Bridges, width	1⅝ ins.
Slide valves; lap, O. 1 in.; I.	3-32 "
Max. travel, 6⅛ ins.; lead	1-64 "
Eccentric travel	5 ins.
Radius of link	5 ft. 8 "
Boiler.—Type	Improved wagon-top
Diam. of barrel inside, at smokebox, 4 ft. 4 ins.; at throat sheet	5 ft. 0 in.
Thickness of barrel plates	7-16 "
Thickness of smokebox tube plate	½ "
Height from rail to center line	7 ft. 9 ins.
Length of smokebox	5 ft. 1 in.
Working steam pressure	180 lbs.
Firebox.—Type	Belpaire
Length inside	6 ft. 6 ins.
Width inside	2 " 10 "
Depth at front	6 " 9 "
Depth at back	6 " 7 "
Thickness of side plates	5-16 in.
" back plate	5-16 "
" crown sheet	⅜ "
" tube sheet	½ "
Grate area	17.4 sq. ft.
Staybolts, diam., ⅞ and 1 in.; pitch	4 ins.
Water space, width back and sides, 3 ins.; front, 4 ins.	
Tubes.—Material, charcoal iron; number	200
Pitch	2 11-16 ins.
Diam. outside	2 ins.
Thickness	13 B. W. G.
Length between tube plates	12 ft. 0 ins.
Heating Surface.—Tubes, exterior	1,258 sq. ft.
Firebox	155 " "
Total with exterior tube area	1,413 " "
Miscellaneous.—	
Exhaust nozzle, diam	3¼ ins.
Smokestack, smallest diam	16 "
Smokestack, height from rail to top	14 ft. 6¼ ins.
Capacity of tank	3,100 gallons
Capacity of coal space	13,400 lbs.
Brake fittings.—Westinghouse driver, tender and train.	

WATER-WORKS INTAKES ON LAKE MICHIGAN.

The small cities and villages along the west shore of Lake Michigan which take their water supplies from the lake have considerable trouble with their intake pipes from various causes, and on the principle that more is to be gained by study of failures than of successes, some account of these experiences may be of value to our readers.

The shore of the lake and the lake bottom, for a depth varying from a few inches to several feet, is a very fine sand, so fine that it is easily moved by the waves and currents, and in the case of violent storms, waves rolling over the shallows near the shore keep this sand in suspension. The lake is, as a rule, shallow for a long distance out, so that in laying intake pipes for water-works, it is necessary to extend the pipe out for a long distance to avoid the sand by reaching water of considerable depth, as well as to avoid the danger of sewage contamination.

At the mouth of the intake the pipe is generally arranged to turn upward and take water from near the surface, and thus avoid the trouble with sand in the pipes and pump which would be experienced if the water were taken anywhere near the bottom. But in thus escaping Scylla the engineer runs foul of Charybdis. In the cold winter weather when the lake is tossed by winds at a zero temperature or colder, the water for several feet below the surface becomes filled with fine floating needles of ice. Wherever these can collect they freeze solid, and as our readers know, they are a much dreaded source of trouble at all the water intakes on the lakes. Even the intake cribs of the large cities are not exempt from the danger, and several cities have had more or less serious water famines from anchor ice stoppages.

Two forms of apparatus operated by compressed air conveyed in a pipe from the shore are in use for preventing anchor ice stoppages; the one in use at the Lake View intake, Chicago, was illustrated and described in our issue of June 27, 1891. It consists merely of a perforated pipe which lets compressed air escape under and across the screens, lifting any anchor ice or other solids adhering to them. The rotating strainer devised by Mr. Jos. G. Falcon, and in use at Evanston, Ill.; Metropolis, Ill.; and Paducah, Ky., was illustrated in our issue of March 30, 1893. Neither of these devices has as yet come into extended use and the intake pipes of small supply systems are liable to frequent stoppages in cold weather.

Nor is this the only danger which threatens the intakes. In the heavy storms abandoned vessels, floating wreckage or driftwood may come sweeping along and hit the intake pipe where it turns up

toward the surface at its outer end. It is commonly protected by driving a few piles; but in a recent storm the intake of a Wisconsin town was carried away by a wreck notwithstanding the pile protection. Of course, when the open end of the pipe on the bottom is exposed by the breakage of the vertical pipe, the intake main and the pumps are soon clogged with sand.

Another danger which besets the intake mains is the shore ice. Water-works were built at Fort Sheridan, Ill., in 1890, and an intake was laid 900 ft. out into the lake consisting of light spiral-welded pipe. One or two sand bars on the line of the intake were dredged across, but for the most part the pipe was laid on the sand bottom and the waves' action was relied on to gradually bury it. The pipe became covered with silt, as was expected, but not deeply enough to materially protect it. Last spring the floating ice in the lake was piled in the shallow water near the shore by the east wind and dug deeply into the sand bottom. The thin iron pipe was badly gashed, and the sand pouring in through the opening soon choked the flow. A cast iron pipe with flexible joints is to be laid to take its place.

FRANKFORT TERMINALS AND BOATS FOR THE TOLEDO, ANN ARBOR & NORTH MICHIGAN RY. CO.'S 63-MILE TRANSFER.

(With Inset.)

The practice of transferring railway cars from one point to another across considerable distances of water by ferry-boats is familiar to most American engineers. Examples of these ferries may be seen in nearly all of the large seaport and lake-port cities, and in many of the smaller towns scattered along our larger rivers. Generally these ferries do not exceed a mile or two in length, and are in waters of such a character as to require very little seaworthiness in the vessels used. There are a few instances, however, in which the conditions demand the use of vessels of very respectable size and considerable sea-going ability. Prominent among these may be mentioned the 35-mile transfer across the mouth of Chesapeake Bay, put in operation early in the last decade, and the 62-mile transfer across Lake Michigan, which was opened for traffic only last fall. The Lake Michigan transfer is the longest in the world, and owing to the often very severe gales on the lake, accompanied by ice in the winter months, involved some interesting problems in the design of the transfer boats and terminals. Some of the principal details of this work are shown on our inset sheet and in the accompanying engravings.

The transfer is owned by the Toledo, Ann Arbor & North Michigan Ry. Co., and forms a part of that company's through freight line from the west to the east, in connection with the Green Bay, Winona & St. Paul and Delaware, Lackawanna & Western railways. As will be seen upon examining a railway map, the Toledo, Ann Arbor & North Michigan Ry. is a line extending from Toledo, O., northwest across the southern peninsula of Michigan, a distance of about 300 miles, to the lake-port at Frankfort, Mich. In this distance the road crosses some 20 railway lines penetrating to all parts of the state. Traversing as it does both the extensive belts of hardwood timber in the northern part of the state, and the agricultural and manufacturing districts further south, by far the greater portion of its business is in the transportation of freight. In fact it is essentially a freight line; the passenger traffic, while remunerative, being purely of a local nature and not of such a character as to demand any special service.

It is evident to one familiar with the resources of the northen half of the southern peninsula of Michigan, that a line of railway depending for its support upon a local freight business, largely of one class of articles, viz., timber products, which is perhaps profitable enough for a time, cannot expect to maintain its earnings after the timber is cut, unless some means can be provided to increase its business and enable it to handle through as well as local traffic. This consideration of the future earning capacity of the property caused the management of the road to make an effort to secure a portion of the business originating in the territory tributary to the cities of St. Paul, Minneapolis and Duluth and destined to eastern and seaboard points. Accordingly, in May, 1892, the company purchased the Frankfort & Southeastern Ry., giving it an outlet on the lake at Frankfort. With this line and through its traffic contracts with the Green Bay, Winona & St. Paul Ry. on the west, and the Grand Trunk and Delaware, Lackawanna & Western railways on the east, the company had a line from Winona, Minn., to the Atlantic seaboard. The worst feature in this route was the water line between Frankfort, Mich., and Kewaunee, Wis., across Lake Michigan. The use of steamers necessitated the breaking of bulk and the rehandling of the freight on each side of the lake, entailing considerable extra cost and delay. For this reason it was decided to adopt a plan for transferring cars without breaking bulk.

In May, 1892, work was begun in improving the grades and alinement of the main line and also upon the yards and terminal buildings at Frankfort. About the same time contracts were let for the transfer boats. Work on the improvements of the main line was well under way before actual work on the slip and transfer bridge could be commenced. In fact it was not until September that pile-driving was begun. After this time work was pushed forward as rapidly as possible with occasional delays on account of heavy winds and rough water, which caused so much rolling of the pile-drivers as to preclude the possibility of accurate work.

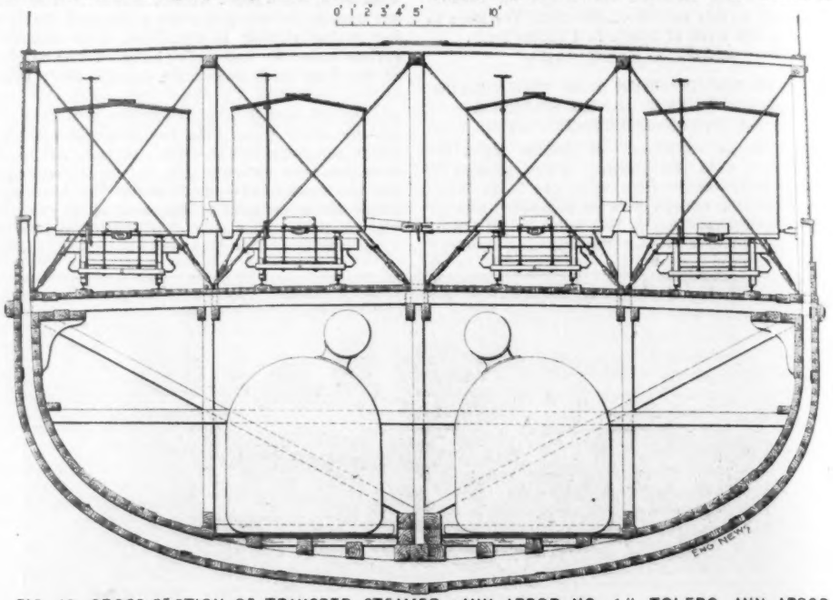


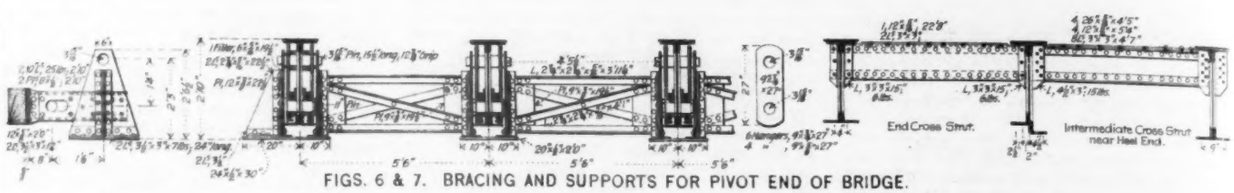
FIG. 15. CROSS SECTION OF TRANSFER STEAMER "ANN ARBOR NO. 1"; TOLEDO, ANN ARBOR & NORTH MICHIGAN RY.

The plans for the slips and for the foundations of the transfer bridges were prepared by Mr. A. Torrey, Acting Chief Engineer of the Michigan Central R. R., Consulting Engineer for the work. The general plan and structural details of slip No. 1 are shown in Fig. 1, on the inset sheet. The cushion consists of two rows of spring piles arranged in couples with three rows of waling, as shown in the detail drawings, Fig. 1. The thrust of the cushion is taken by a system of back piling. The back piles are arranged in rows of three piles each with a 12×12-in. cap connecting the piles of each row. The caps of the back piles are on a level with the lower back row of waling on the cushion; the caps being cut off on a line parallel with the front of the cushion and 6 ins. from the waling. The play allowed the cushion is thus 6 ins. At the bridge end of the slip where the tracks on the transfer bridge connect with those on the boat it is, of course, necessary to reduce the possible lateral movement of the boat as much as possible. For this purpose a wedge shaped oak timber, 30 ft. long, 6 ins. thick at one end and tapering to an edge at the other, is bolted to the lower back waling of the cushion. As will be seen this timber fills the 6-in. space between the waling and the caps of the back piling at one end, preventing any motion of the cushion, while at the other end the full 6-in. play of the cushion is permissible. The bridge end of the boat is thus held firmly in one position as far as any very considerable lateral motion is concerned. The minor constructive details of the slip are clearly shown in the illustration and need no description.

Considerable care was required in driving the piles, since it was necessary to have the cushion conform closely in form to the side lines of the boats entering the slip. The center line of the boat was first carefully established and transit points placed on both sides of the harbor on this line. Four lines parallel with this center line at distances of 36 ft., 86 ft., 136 ft. and 186 ft. were then established and transit points located at the intersection of these lines and the lines of piles in the foundations of the transfer bridge and approach. The piles were set by measurement from one of the four lines and ranged by transit or by flags set on the transit points. The piles in the nose of the slip were all set by measurement from the center line of the boat, temporary piles being driven on that line and capped by pieces of 8×12-in. timber.

The pile-drivers were mounted on scows. The length of leaders was 55 ft. and the weight of the hammer 2,800 lbs. Near the shore the bottom of the harbor was full of slabs, edgings and old pile heads, causing some trouble. The soil penetrated was a hard white clay, making very hard driving. Notwithstanding all this very good progress was made, no piles having to be drawn on account of bad alinement, and by using a "bonnet" no piles were split. Farther away from the shore a very soft black mud was found which necessitated a change in the original plans by substituting 70-ft. piles in place of 45-ft. piles, and continuing the cross bracing of the back piles throughout the entire length of the slip instead of for 72 ft., as shown in the plan, Fig. 1. These 70-ft. piles were pine, but all the 45-ft. piles of the cushion were of rock elm and oak. The 3×8-in. back waling and 6×10-in. fenders were of white oak, and all the ribbing rock elm. The caps and all timber used in bracing the back piling were rock elm. The drift bolts were 1-in., 1⅛-in. and 1¼-in. iron.

In Figs. 2 and 3 are shown the details of the timberwork for the gallows frame and foundations of the transfer bridge. These illustrations show the framing in such detail as to require but little explanation. The timber for the foundations of the bridge was white pine and white oak; the caps and blocking for the winding drum being pine and the floor, backing and blocking for the bridge being oak. All the timber used in the gallows frame was white pine with the exception of the four upper caps, which were white oak. Both oak and rock elm were used for the sheet piling. The framing and erection of all the timber work was done by



FIGS. 6 & 7. BRACING AND SUPPORTS FOR PIVOT END OF BRIDGE.

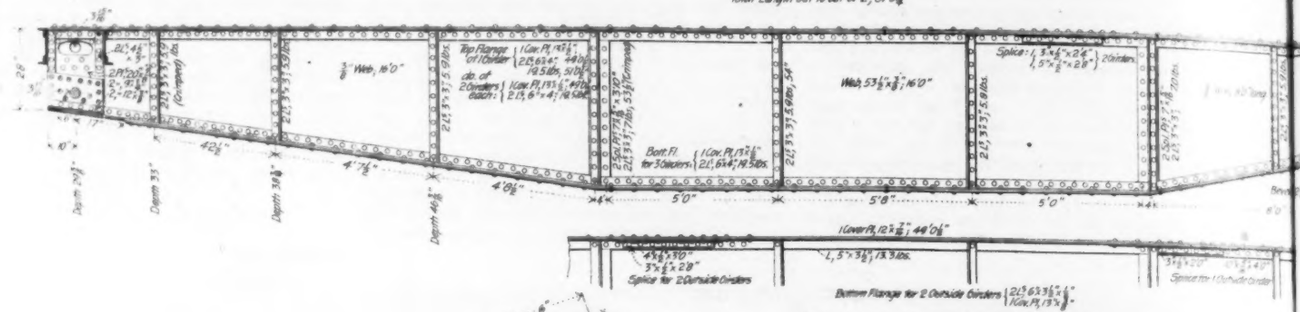
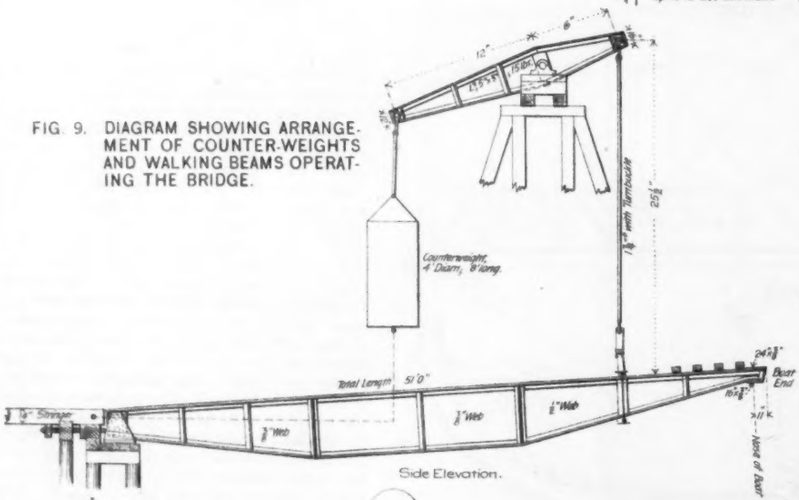


FIG. 4. MAIN GIRDER OF BRIDGE.

FIG. 9. DIAGRAM SHOWING ARRANGEMENT OF COUNTER-WEIGHTS AND WALKING BEAMS OPERATING THE BRIDGE.



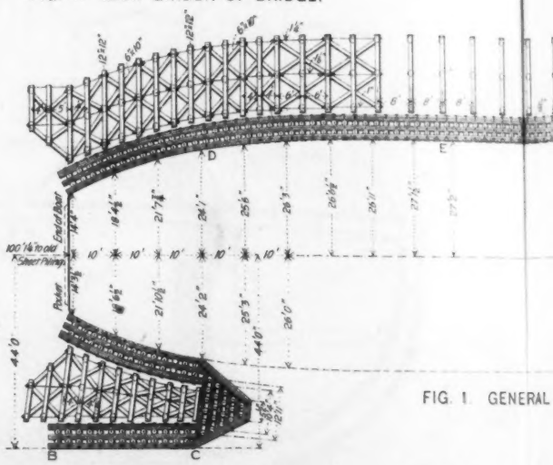
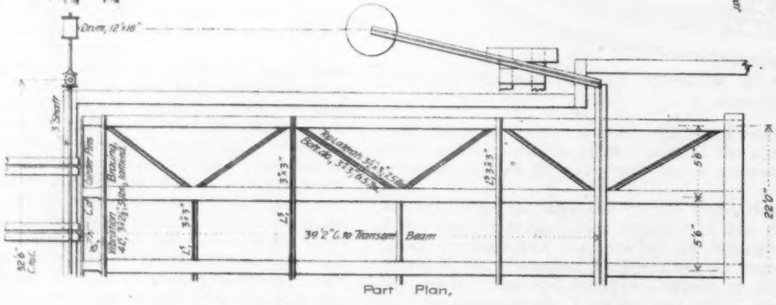
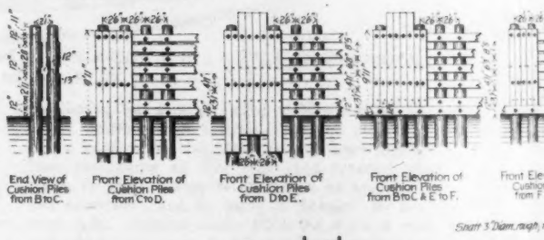


FIG. 1. GENERAL




End View of Cushion Piles from B to C.
Front Elevation of Cushion Piles from C to D.
Front Elevation of Cushion Piles from D to E.
Front Elevation of Cushion Piles from B to C & E to F.

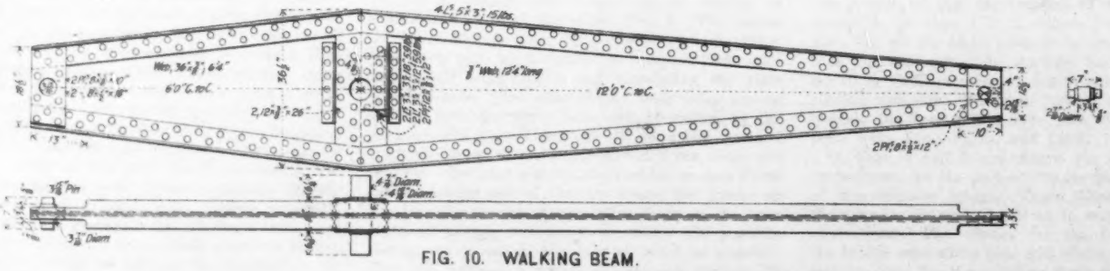
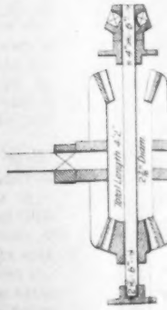


FIG. 10. WALKING BEAM.



TRANSFER BRIDGE AND SLIP FOR THE TOLEDO, ANN A

H. E. Riggs, Chief Engineer. A. Torrey, Consulting Engin

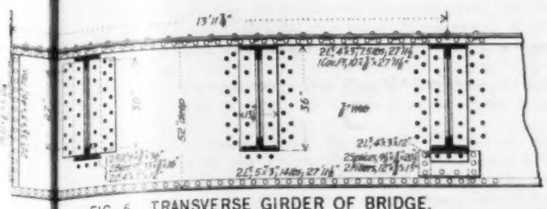


FIG. 5. TRANSVERSE GIRDER OF BRIDGE.

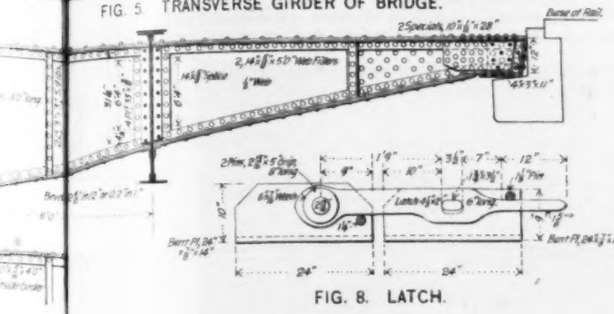


FIG. 8. LATCH.

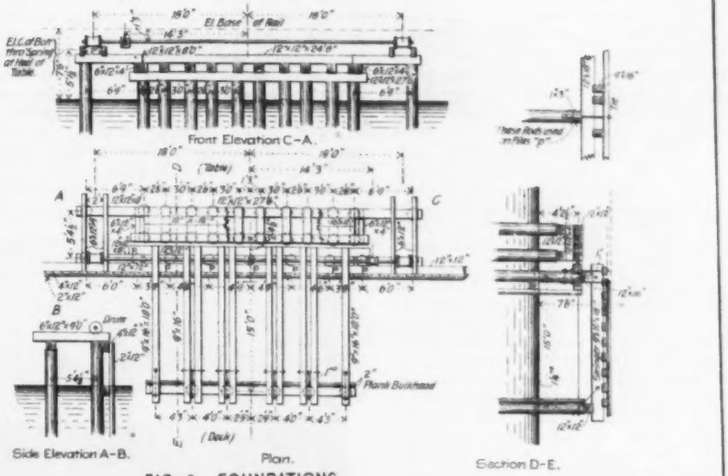
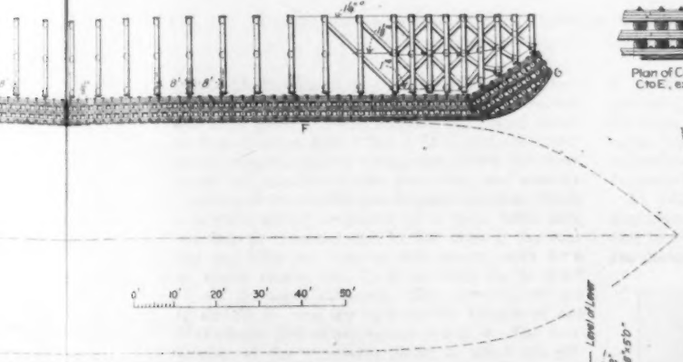
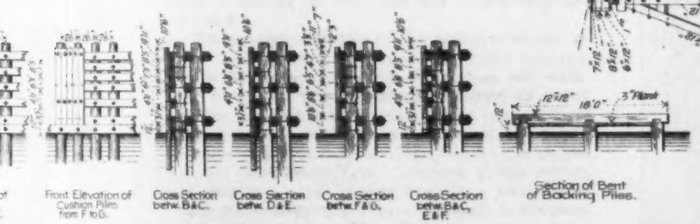


FIG. 3. FOUNDATIONS FOR BRIDGE.



1. GENERAL PLAN AND DETAILS OF SLIP No. 1.



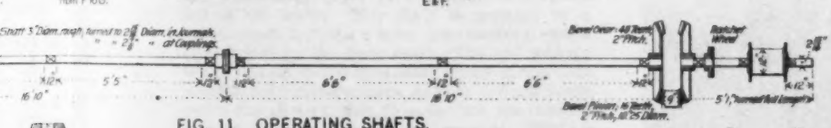
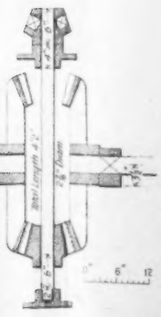


FIG. 11. OPERATING SHAFTS.



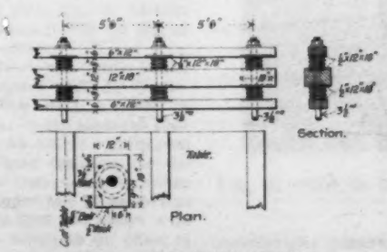


FIG. 13. ENLARGED DETAILS OF SPRING CUSHION.

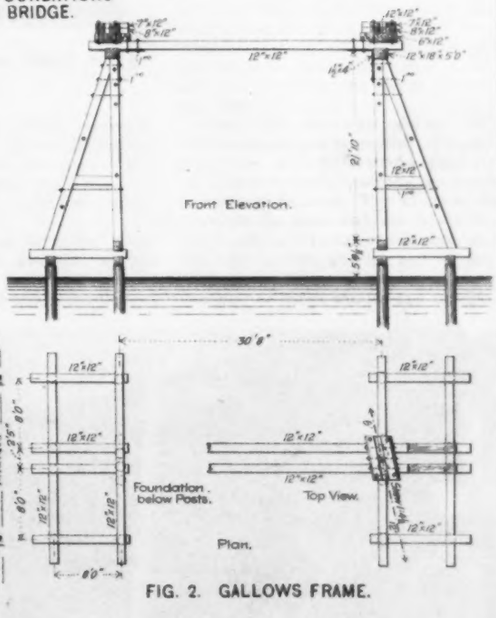


FIG. 2. GALLOWS FRAME.

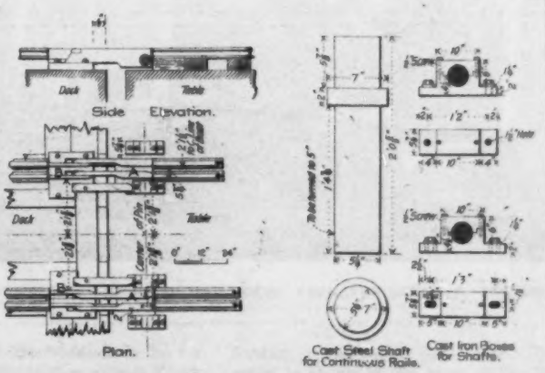
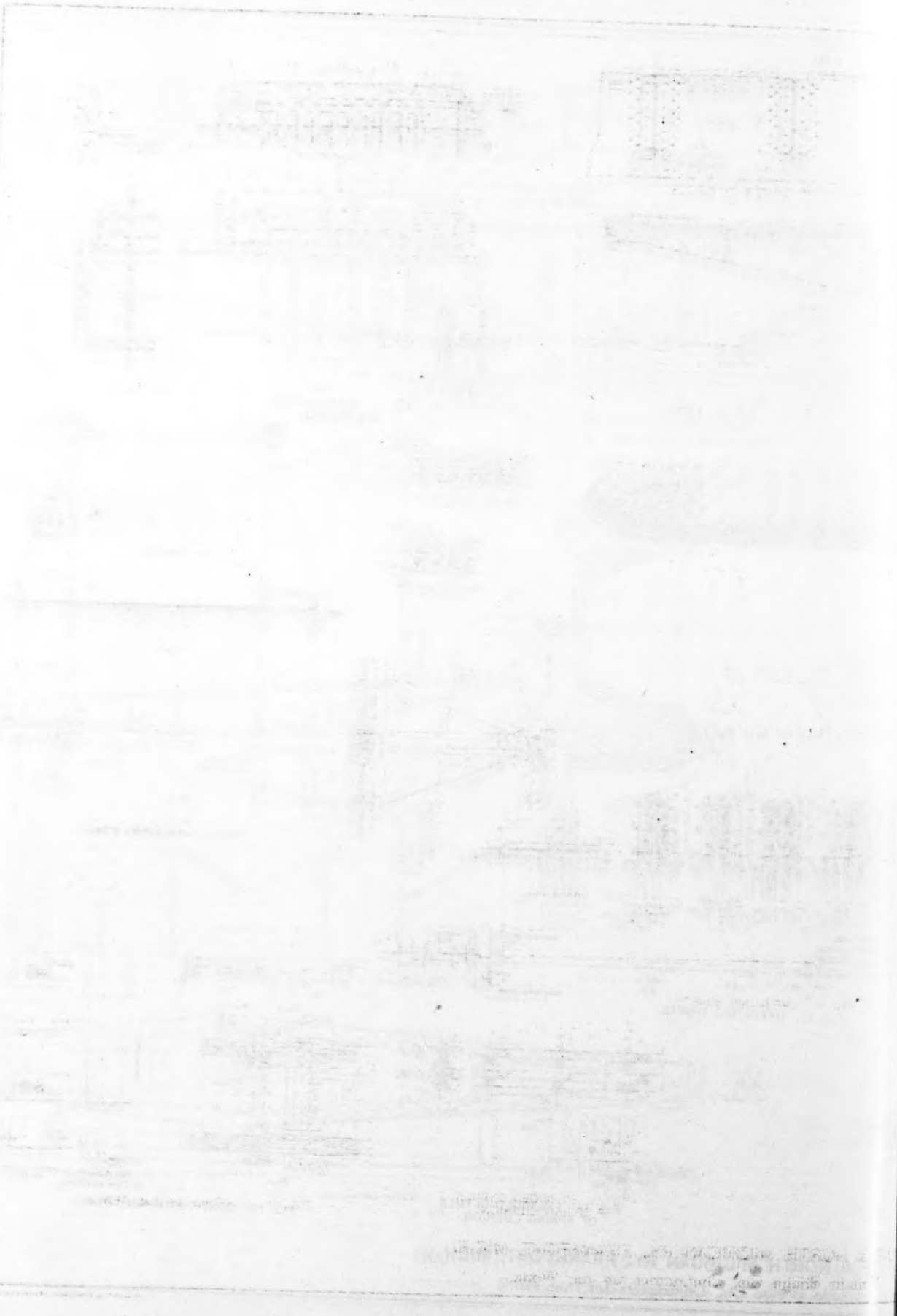


FIG. 12. CONTINUOUS RAIL DEVICE.

ANN ARBOR & NORTH MICHIGAN RY., FRANKFORT, MICH.

ng Engineer. Toledo Bridge Co., Contractors for Iron Work.

CHAS. HART & SONS, LITH., 26 VESEY ST., N. Y.

the railway company under the supervision of Mr. James Turnbull.

Upon the completion of the foundation for the bridge and the gallows frame the erection of the transfer bridge was immediately begun. A temporary floor was first constructed and tracks laid on the approach. The girders were then slid into position on temporary tracks. It took but six working days to erect the bridge.

The ironwork for the transfer bridge was executed by the Toledo Bridge Co., after designs by their Chief Engineer, Mr. C. L. Gates, M. Am. Soc. C. E. Its general dimensions, construction and operation are shown in Figs. 4 to 11 inclusive. The bridge is 51 ft. ¼ in. long back to back of

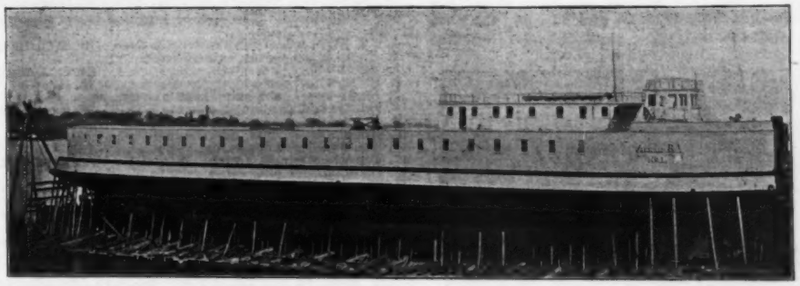


FIG. 14. TOLEDO, ANN ARBOR & NORTH MICHIGAN RY. TRANSFER STEAMER "ANN ARBOR NO. 1." Craig Ship Building Co., Designers and Builders.

angles, 28 ft. wide c. to c. of outside girders, and provides for four standard gage railway tracks. The main girders, five in number, are placed parallel to each other, 5 ft. 6 ins. c. to c., and are firmly braced together by the transverse girder, the cross struts and bracing at the pivot end, and also by a system of transverse and diagonal bracing. Each is a plate girder consisting of a ⅜-in. web, 27½ ins. deep at the fixed end, 11 ins. deep at the boat end and 53½ ins. deep at the center, with 6×4 in. chord angles and 3×3 in. ×5.9 lb. to 3×3 in. ×7 lb. angle stiffeners. The cover plates are 13 ins×½ in., one for each chord. Details of one of the main girders are shown in Fig. 4. The composition of the transverse girder to which the gallows chains for raising and lowering the bridge are attached is shown in Fig. 5. Details of the bracing and supports at the pivot end are shown in Figs. 6 and 7, and of the boat end and latches in Figs. 4 and 8.

The general operation of the bridge is shown in Fig. 9. A gallows frame placed near the boat end of the bridge carries over each tower an iron walking beam, one end of which is attached by a rod to the transverse girder and to the other end of which is suspended the counterweight. The two counterweights a little less than balance the weight of the unloaded bridges. Attached to the bottom of each is a cable passing down to a sheave and then horizontally to the operating shaft at the pivot end of the bridge. This shaft is operated by a vertcal shaft carrying a bevel gear meshing with a similar gear on the drum shaft. The two walking beams are connected by a plate girder at the ends opposite the counterweights, and are inclined to the center line of the bridge, so as to allow the counterweights to swing clear of the structure. This arrangement is shown in the plan, Fig. 9. Details of the walking beams are shown in Fig. 10, and of the operating shafts in Fig. 11.

In Figs. 12 and 13 are shown the details of the expansion joint and "continuous rail" device, designed by Mr. A. Torrey. This device is similar to one used at Mackinaw, Mich., by the Michigan Central R. R. for some years. As will be readily seen this arrangement was rendered desirable for the reason that the tracks at the boat end of the bridge are not parallel with the center line of the bridge and the boat, and unless the boat and bridge were held rigidly together there would be an offset in the tracks like the lip of a stub switch. At the same time there needed, of course, to be some elastic connection between the boat and the bridge or the latter would soon have been wrecked, since the boat has a capacity of something over 1,000 tons. It became necessary, therefore, to put this elastic or expansion joint at the shore end of the bridge, and, as will be seen from Fig. 9, the bridge is connected with the dock by a spring cushion. Details of this cushion are shown in Fig. 12. With this opportunity for movement, the opening at the shore end of the bridge, under unfavorable inclinations of the bridge, which were liable to occur at the same time that the boat might drag back on the bridge, would exceed 6 ins. This, of course, was too great an opening to leave in the track, and necessitated some device for bridging the opening. The arrangement adopted is shown in Fig. 13. It consists of two steel castings, one of which is fastened rigidly to the dock and the other of which is attached by a horizontal pivot resting in cast iron boxes fastened to the boat. The casting attached to the boat, and designated by the letter A in the illustration, slides in suitably arranged grooves in the dock casting, B. By examining the drawings this arrangement of the two castings will easily be seen. It is stated that this device, although somewhat expensive, has worked very satisfactorily in practice.

As will be readily understood by those at all acquainted with the difficulties attending navigation in our great lakes during the winter months, the design of the transfer boats was a question of considerable importance. The distance to be traversed was 63 miles; and the harbors at both Frankfort and Kewaunee, while naturally good, require considerable improvement before they can be termed first-class harbors. Moreover, during the winter they are often frozen over; the ice sometimes forming to a depth of several feet, and, in addition, there is usually much difficulty experienced with anchor ice. Great strength was, therfore, necessary in the framing to enable the boats to withstand the pressure and shocks from the ice.

The steamers were built by the Craig Ship Building Co., of Toledo, O., and were designed by Capt. John Craig, of that company. The two vessels first constructed were known as "Ann Arbor No. 1" and "Ann Arbor No. 2," and were sister vessels. "Ann Arbor No. 1" is shown as she stood on the ways ready for launching in Fig. 14. A cross-section of the same vessel, to which "Ann Arbor No. 2" corresponds in all particulars, is shown in Fig. 15. The main dimensions of these boats are: Length over all, 267 ft.; beam, 52 ft., and depth of hold, 18½ ft. The draft is about 12 ft., and the displacement 2,550 tons. The frames are solid on the bottom and for a distance of 3 ft. above and 3 ft. below the water line. For a distance of 50 ft. the bow is also solid from the keel to 3 ft. above the water line. To prevent the vessel being crushed if nipped by the ice, extra deckbeams are placed at the load line. She is also strengthened longitudinally by a steel chord with diagonal steel ties running to the keel at every 4 ft. and by a pair of ⅝×24-in. steel plates bolted to the keelson and running the entire length of the vessel. The outside planking is 5-in. oak sheathed with 3-16-in. steel plates for a distance of 4 ft. above and 4 ft. below the water line. The bow of the boat is sheathed with steel clear to the keel. The vessel is designed to ride over and crush down the ice rather than to crush through it, and to this end the bow has a very rank sheer extending down to the screw itself. There are three screws, one at the bow and two at the stern.

These three screws are operated by three sets of horizontal compound engines with cylinders 20 ins. and 40 ins., and a 36-in. stroke. Each is supplied with an independent condenser and can be worked at high pressure if required. Two of these engines are located in the stern and one in the bow. The two stern engines are connected to two shafts operating the twin screws, and the bow engine operates an extra heavy screw in the bow which is especially designed to break the ice and to clear the bow by forcing it underneath the vessel. This forward screw is shown in the view of the bow of "Ann Arbor No. 1," Fig. 16. There are four fire-box boilers, two of which are in the bow and two in the stern, and supply steam to the forward and after engines, respectively. The boilers are so arranged, however, that all four can be connected with the after engines when necessary. The boilers in the stern are 10.6 ft. in diameter

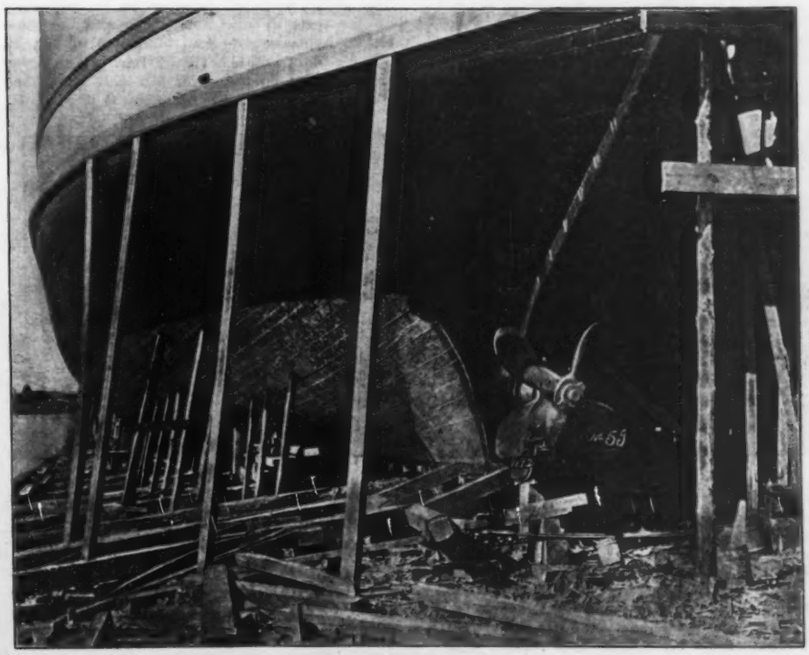


FIG. 16. VIEW OF BOW SHOWING ICE BREAKING SCREW; TRANSFER STEAMER "ANN ARBOR NO. 1."

and 15 ft. long, and those at the bow 6 ft. 6 ins. in diameter and 15 ft. long. The working pressure is 125 lbs. per sq. in. Cards from each of the engines show 610 HP. at 86 revolutions per minute. The vessels are equipped with steam steering gear, steam windlasses and capstans, electric lights, including a search light, and all requisites for securing safety.

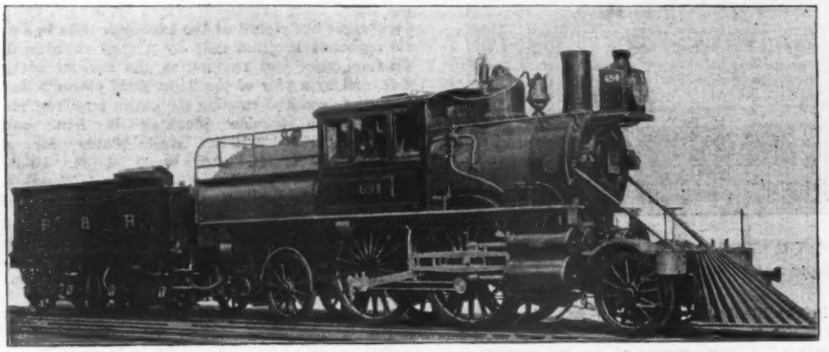
The car deck contains four tracks with a capacity of 24 cars, the frogs being on the boat and the leads partly on the boat and partly on the bridge. Ample provisions are provided for securing the cars. Two posts are placed on each side of each car between which the cars are wedged by keys. These posts are connected longitudinally by heavy stringers, and diagonal tierods are put in between each two cars. These tierods are provided with turnbuckles to properly adjust their lengths. The cars are also held to the deck by four chains attached to the car body, as shown in Fig. 15, each with a turnbuckle.

In respect to the working of these vessels in ice, a correspondent informs us that steamer No. 2 left the shipyards on Dec. 24, 1892, with from 8 ins. to 10 ins. of ice around her and encountered ice all the way. In the Straits of Mackinaw she passed through ice which had been piled up in windrows 4 ft. thick. These conditions would seem to demonstrate the vessel's power to break through almost any depth of ice likely to be encountered in regular traffic. This same vessel has made the round trip from Frankfort to Kewaunee and return, 126 miles, in 14 hours 30 minutes, and this during severe weather and with considerable trouble from anchor ice. In another instance steamer No. 1 ran aground at full speed during a heavy fog and lay 2½ ft. out of water with the seas running over her during a storm so severe that for a week no tugs could reach her. After the storm was over it took the combined power of five powerful tugs aided by the vessel's own engines working up to 110 revolutions per minute, to pull her clear. There were no signs of leaking and the vessel went directly back to her route as soon as released.

In this connection it is interesting to state that these steamers have been approved by the United States naval authorities as first-class harbor defense boats in case of hostilities. The change would be made by cutting off the upper works, placing two revolving turrets on the deck and ballasting the boat from 12 ft. draft to 15 ft. draft. As may be seen these boats are much better adapted for use as gunboats than the ordinary lake boats, since the decks are so strong, heavy and well supported that they will withstand the firing of heavy guns without much extra bracing.

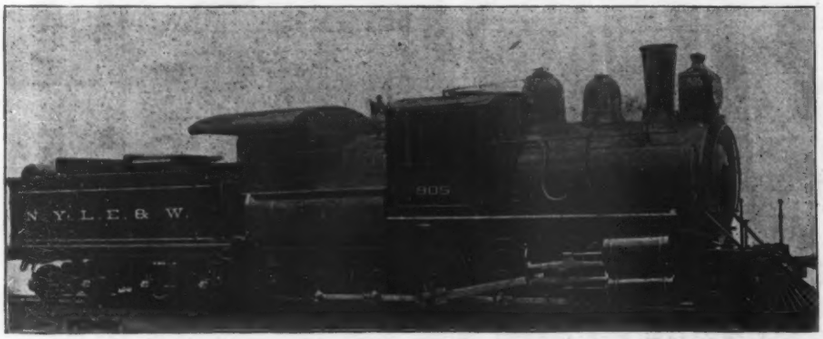
In conclusion, it may be said that these vessels have been in daily operation since Nov. 15, 1892, and have weathered some of the most severe storms of the past winter. In these trips they have handled from 18 to 24 carloads, and the company considers that they have demonstrated that it is a thoroughly practical method of transferring freight as well as a more economical one than that of breaking bulk.

The entire work of construction in connection with the transfer slips and bridge and the other terminal improvements was in charge of Mr. H. E. Riggs, Chief Engineer of the Toledo, Ann Arbor & North Michigan Ry., with Mr. A. Torrey, Acting Chief Engineer of the Michigan Central R. R., as Consulting Engineer. We are indebted to these gentlemen and to the Craig Ship Building Co., for the matter from which our illustrations and the accompanying description have been prepared.



DOUBLE-ENDER EXPRESS ENGINE; PHILADELPHIA & READING R. R.

Exhibited by the Baldwin Locomotive Works at the World's Columbian Exposition.



DECAPOD FREIGHT ENGINE; NEW YORK, LAKE ERIE & WESTERN R. R.

Exhibited by the Baldwin Locomotive Works at the World's Columbian Exposition.

WORLD'S COLUMBIAN EXPOSITION.—XIV.

Exhibit of the Baldwin Locomotive Works.

The exhibit of American locomotives is one of special interest, for the number of engines, for the enormous power of the largest, and for the fact that the engines represent regular practice and are not engines built for show. The Baldwin Locomotive Works exhibit no less than 17 engines, 13 of which are in the Railway Department of the Transportation Building, 3 in the special exhibit of the Baltimore & Ohio R. R. (two being standard B. & O. engines), and 1 ten-wheel engine in connection with the Pullman Palace Car Co.'s exhibit. These works were established in 1831, and on May 1, 1893, completed engine No. 13,420. During the ten years, 1883-1892, inclusive, 6,571 engines were built, including 1,356 for export, the greatest number built in any one year being 946, in 1890, exclusive of repairs, etc. The present works, with a capacity of 1,000 locomotives per annum, cover 16 acres, employ 5,100 men and have machinery representing 5,000 HP. The erecting shop is 337×160 ft., with 19 tracks and a capacity for 76 engines. It is fitted with two Sellers' electric traveling cranes of 100 tons capacity. The exhibit comprises nearly every type of engine, and includes several Vauclain four-cylinder compounds. The list of engines is as follows:

1, 2, 3. Eight-wheel simple, express pass....B. & O. R. R.
4. Eight-wheel simple, express pass.
5. Eight-wheel compound, express pass....B. & O. R. R.
6. Eight-wheel compound, express pass. C. R. R. of N. J.
7. Eight-wheel compound, pass. and freight.
8. Double end compound, express pass. Phil. & Read. R. R.
9. Double-end compound, express pass.
10. Mogul simple, pass. and freight.
11. Ten-wheel compound, express pass.
12. Ten wheel simple, freight..B. & O. Southwestern R. R.
13. Consolidation compound, freight. Norf. & West. R. R.
14. Consolidation compound, freight...Mexican Natl. Ry.
15. Decapod compound, freight....N. Y., L. E. & W. R. R.
16. Logging (four-coupled, leading and trailing pony trucks).
17. Tank switching engine for mill purposes (four wheels, all coupled).

Of these 17 engines all but two are for regular railway service, and nine are compounds. No. 14 is 3 ft. gage. No. 6 was illustrated and described in our issue of Dec. 8, 1892, and the double-end type, Nos. 8 and 9 (four-coupled wheels, with leading and trailing pony trucks), for express traffic, was described in our issue of Nov. 21, 1891. Engines Nos. 8 and 15 are illustrated herewith, and the following table gives their general dimensions. They are both notable engines, the first being practically a new type for express service, which is used extensively on the Philadelphia & Reading R. R., and the second being one of the heaviest and most powerful engines ever built for freight service. We are indebted to the builders for photographs and information:

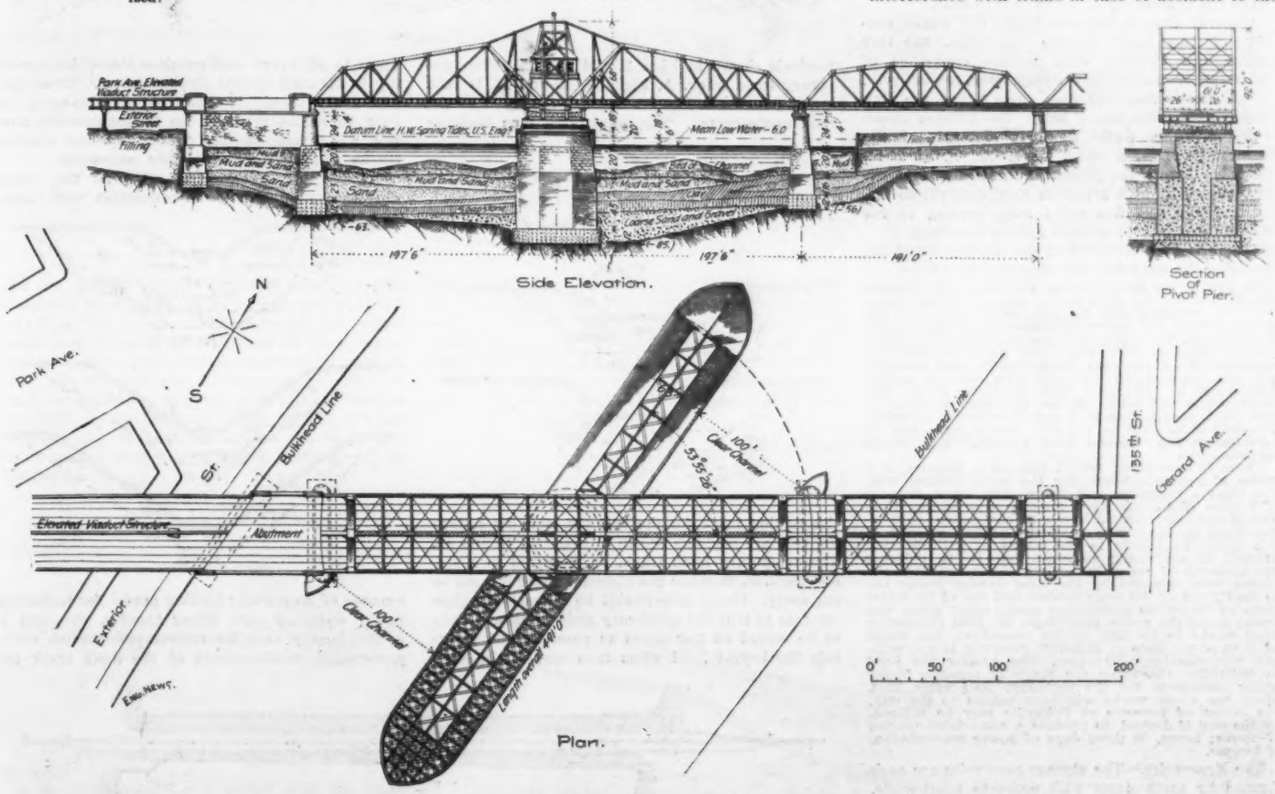
	N. Y., L. E. & W. R. R.	Philadelphia & Read. R. R.
	Decapod freight.	Express passenger.
Running Gear:		
Driving wheels, diam.	4 ft. 2 ins.	6 ft. 6 ins.
Truck " "	2 " 6 "	4 " 0 "
Tender " "	2 " 9 "	3 " 0 "
Engine truck, length of radius bar	5 " 9 "	.....
Engine truck, swing or rigid center	Swing bolster	.....
Journals, driving axles	9 × 10 ins.	8½ × 12 ins.
" truck "	5 × 10 "	6½ × 10 "
" tender "	4½ × 9 "	4½ × 8 "
Wheel base:		
Driving	18 ft. 10 "	6 ft. 10 "
Total engine	27 ft. 3 ins.	23 ft. 4 ins.
" tender	16 " 8 "	16 " 0 "
" engine and tender	53 " 4 "	47 " 3 "
Center of truck pin to center of leading driver	8 " 5 "	.....
No. and order of wheels having blind tires	2d and 3d pair	.....
Total length of engine and tender	.....	62 ft. 7½ ins.
Weight in working order:		
On drivers	170,000 lbs.	82,700 lbs.
On truck wheels	29,500 "	47,000 "
Engine, total	192,500 "	129,700 "
Tender, "	117,500 "	80,573 "
Engine and tender, loaded	310,000 "	210,273 "
Tender, empty	.....	33,800 "
Of full water capacity of tank	103,500 lbs.	.....
Cylinders:		
h. p (2)	16 × 28 ins.	13 × 24 ins.
l. p. (2)	27 × 28 "	22 × 24 "
Distance center to center	7 ft. 5 "	7 ft. 4½ ins.
Piston rod, diam.	4 ins.	3½ ins.
Form of crosshead and guides	Four-bar guides	.....
Connecting rod, length between centers	9 ft. 8⅞ ins.	8 ft. 6¼ in.
Valve Gear.—Type	Sliding link	.....
Steam ports, circular	2⅝ × 2 ins.	2½ × 1½ ins.
Exhaust ports, "	2⅝ × 8 "	2½ × 4½ "
Slide valves, out. lap, h. p.	⅞ in.	⅞ in.
" " out. lap, l. p.	⅝ "	⅝ "
" " in. lap, h. p.	.....	(neg.) ⅛ in.
" " in. lap, l. p.	.....	None
" " max. travel	6 ins.	5 ins.
" " lead, h. p.	1/16 "	⅛ "
" " " l. p.	1/16 "	⅜ "
Boiler.—Type	Straight	Straight
Diam. of barrel inside	6 ft. 2⅛ ins.	4 ft. 8½ ins.
Thickness of barrel plates	¾ "	⅝ "
Thickness of smokebox tube plate	¾ "	½ "
Height from rail to center line	8 ft. 0 ins.	.....
Length of smokebox	5 " 7⅛ "	.....
Working steam pressure	180 lbs.	180 lbs.

Firebox.—Type	Wootten	Wootten
Length inside	10 ft. 11⅞ ins.	9 ft. 6 ins.
Width "	8 " 2⅛ "	8 " 0¼ "
Depth at front	4 " 6 "	3 " 2¾ "
" " back	4 " 2 "	.....
Thickness of side plates	½ "	⅜ in.
" back plate	½ "	½ "
" crown sheet	⅝ "	½ "
" tube "	⅝ "	½ "
Crown plate, radial stays, diameter	.....	1¼ "
Grate area	89.6 sq. ft.	76.8 sq. ft.
Staybolts, diam., 1¼ ins.	pitch, 4¼ ins.	.....
Water space, width	.....	3½ ins.
Tubes.—Iron	351	324
Pitch	2¾ ins.	2⅛ ins.
Diam., outside	2 "	1¾ "
Thickness	.....	13 B. W. G.
Length betw'n tube plates	11 ft. 11 ins.	10 ft. 0 in.
Total fire area of tube openings	7.72 sq. ft.	.....
Heating Surface:		
Tubes, exterior	2,208.8 "	1,262 sq. ft.
Firebox	234.3 "	173 "
Total with exterior tube area	2,443.1 "	1,435 "
Miscellaneous:		
Exhaust nozzle, diam	5 ins.	5⅛ ins.
Smokestack, smallest diam.	1 ft. 6 "	1 ft. 6 "
" height from rail to top	15 " 6⅛ "	14 " 0¾ "
Capacity of tank	4,500 gals.	4,000 gals.
" coal space	14,000 lbs.	13,440 lbs.
Brake fittings;	Westinghouse American, outside equalized.	

wheel truck. The leading dimensions of these three engines are as follows:

	L. S. & M. S. Ry. Ten-wheel.	Gt. North. Ry. Consolid't'n.	Chic. & N. Pac. R. R. Tank.
Driving wheels	4 ft. 8 ins.	4 ft. 7 ins.	5 ft. 3 ins.
Wheel base, driving	13 " 3 "	15 " 6 "	15 " 0 "
Wheel base, engine	23 " 1½ "	23 " 0 "	35 " 9 "
Wheel base, eng. and tender	45 " 6¾ "	49 " 11¾ "	.....
Weight, on drivers	76,500 lbs.	130,000 lbs.	102,000 lbs.
Weight, total	102,000 "	147,000 "	105,000 "
Cylinders, h. p.	(1) 18 × 24 ins.	(2) 13×26 ins.	18 × 24 ins.
" l. p.	(1) 28½ × 24 "	(2) 22× 26 "	.....
Boiler, diam	4 ft. 4 ins.	5 ft. 3 ins.	4 ft. 10 ins.
Firebox	96 × 24⅛ ins.	114 × 32 ins.	102 × 32 ins.
Coal	13,440 lbs.	17,920 lbs.	10,080 lbs.
Water	3,700 gals.	4,000 gals.	2,800 gals.

These works were established in 1869, by Mr. H. G. Brooks, Superintendent of Motive Power of the New York, Lake Erie & Western R. R., when Mr. Gould ordered the Dunkirk shops of that road to be closed, but the property was owned by the railway company until 1883. About 2,300 engines have been built, and the works have a capacity of 25 engines per month. In another column we describe and illustrate the engines built here to haul the "Exposition Flyer" over the Lake Shore & Michigan Southern Ry.



NEW DRAWBRIDGE OVER THE HARLEM RIVER; NEW YORK CENTRAL & HUDSON RIVER R. R.

Exhibit of the Brooks Locomotive Works.

In our issue of June 16 and July 7, 1892, we illustrated and described an immense freight engine of the twelve-wheel, a mastodon type built by the Brooks Locomotive Works, for the Iron Range & Huron Bay Ry., and an engine of similar type, for the Great Northern Ry., is one of the nine engines exhibited by these works. The exhibit includes the following engines:

Eight-wheel simple, passenger	Cin., Ham. & Dayton R. R.
Ten-wheel simple, passenger	L. S. & M. S. Ry.
" compound, freight	" "
" simple, passenger	Great Northern Ry.
Mogul " freight	" "
Consolidation compound, freight	"
Twelve-wheel simple, "	"
Switching " six-wheel	"
Tank, simple, suburban	Chicago & North. Pac. R. R.

The two compound freight engines are of different types. The consolidation engine of the Great Northern Ry. has four cylinders, two (arranged tandem) on each side, while the ten-wheel engine of the Lake Shore & Michigan Southern Ry. is of the two-cylinder type. The suburban engine of the Chicago & Northern Pacific R. R. has six coupled wheels, a leading pony truck and a trailing six-

HARLEM RIVER DRAWBRIDGE; NEW YORK CENTRAL & HUDSON RIVER R. R.

The new viaduct on Park Ave., New York, by which the grade of the New York Central R. R. will be elevated to a new high level bridge across the Harlem River, was illustrated and described in our issue of May 25, and we give this week a general elevation and plan of the new bridge, which will be a very heavy structure, carrying four tracks and designed for heavy trains running across at speed. The bridge crosses the river at an angle of nearly 54°, and leaves a waterway of 100 ft. width in the clear on each side of the pivot pier. The clear headway is 24 ft. above high water, and 30 ft. above mean low water. The bridge when open will be protected by a strong pile and timber pier 491 ft. long and 63 ft. wide. The drawspan has a total length of 398 ft. total, with truss approach spans at the north end.

The foundations for the pivot pier will be sunk by the pneumatic process and carried down to solid rock, 85 ft. below high water. The work will be through mud, sand and mud, clay, soapstone (a singular formation, being a pocket of soapstone above gravel), and coarse sand and gravel. The pier will be of stone masonry, of simple but bold design, with a concrete heart, and the rails of the live ring of the turning gear will be about 6 ft. above high water line. The solid floor will be of the trough pattern used on the viaduct, and already described. There are three main trusses of heavy construction, the members seating on the turntable being arranged by equalizing girders to distribute the load uniformly over the 144 wheels supporting the double "drum" or circular girder. The width is 61 ft. over the trusses, the clear spaces between the trusses being 26 ft. wide in the clear. The depth of truss at center is 68 ft. The turning machinery will be operated by steam, from a cabin carried above the tracks, as shown. The boilers, engines, gearing, locking plant and all machinery will be in duplicate, so as to avoid the chance of interference with traffic in case of accident to the machinery. The general design was prepared by Mr. Walter Katte, M. Am. Soc. C. E., Chief Engineer of the New York Central & Hudson River R. R. The calculations and details were worked out by Mr. Geo. H. Thomson, Engineer of Bridges, and Mr. Frank W. Wilson, Constructing Draftsman. The contract for the superstructure has been let to the King Bridge Co., of Cleveland, O. The estimated cost is $300,000 for the foundations and substructure and $224,000 for the superstructure, making a total of $524,000.

THE WORKS OF THE EAST JERSEY WATER CO. FOR THE SUPPLY OF NEWARK, N. J.

Aside from the new Croton aqueduct, probably the most important and in some respects the most unique engineering work which has recently been completed is the water supply system for the city of Newark, N. J., which was put in operation about a year ago, or on April 26, 1892. An illustrated description of this system was given in Engineering News of Oct. 11, 1890, and Aug. 1, 8 and 15, 1891, but the works were not then com-

pleted and all the details of design and construction were not available.

Most happily for the engineering profession the works have now been fully described by the engineer, Mr. Clemens Herschel, M. Am. Soc. C. E., in an exhaustive and profusely illustrated paper presented by him before the New England Water-Works Association, at Worcester, Mass., this week. An abstract of this paper is begun below, those parts being omitted which in substance have already appeared in these columns.

For a proper understanding of what follows it needs to be stated that the works of the East Jersey Water Co. furnish a substitute supply to that drawn for many years from the Passaic River, at Belleville, and pumped to reservoirs. The company contracted to build works with a daily supply capacity of 50,000,000 gallons for $6,000,000, but only $4,000,000 of this sum was to be paid on completion of the works, the company having the right in lieu of the remaining $2,000,000 to sell 22,500,000 gallons of water per day to supply other municipalities between May 2, 1892, and Sept. 24, 1900, when the city will pay the $2,000,000 and have the full supply of 50,000,000 gallons.

General Description.—In brief, the works consist of two large storage reservoirs, the Oak Ridge and Clinton, with storage capacities of 2,555,000,000 and 3,518,000,000 gallons, respectively; of an intake reservoir nine miles below the Oak Ridge and seven miles below the Clinton reservoir, to which water flows in channels of the natural streams; a 48-in. steel conduit, 21 miles long, leading to the present Belleville or low service reservoir, with a branch steel conduit, 36 ins. in diameter and five miles long, leading to the South Orange Ave. or high service reservoir.

Regarding the elevation of the reservoirs and the grade of the conduits, Mr. Herschel states:

In profile, we have Clinton wasteway on elevation 992 ft. above mean level of the sea; Oak Ridge wasteway, on elevation 836; Macopin Intake Dam, on elevation 583.7; the hydraulic gradient of the conduit falling 2 ft. per 1,000, and reaching Belleville reservoir at elevation 358, while full water in Belleville reservoir is on elevation 168.4; finally, the hydraulic gradient reaching South Orange Ave. reservoir at elevation 300, in accordance with the terms of the contract, while full water in this reservoir is on elevation 226.6, though that of a new distributing reservoir, proposed to be built by the city, and to serve what is now called the "Special High Service," may be on elevation 300.

There is thus given 408 ft. fall, on a distance of 7 miles of mountain brook, for the water issuing from the Clinton reservoir, and 252 ft. fall, on a distance of 9 miles of a rocky river, for the water issuing from Oak Ridge reservoir, in which to be aerated in flowing down to the intake. And the unusual amount of fall from the intake to the points of delivery was utilized in generating velocity; that is, in reducing the diameter of the main conduit. As it has from the outset been intended by the East Jersey Water Co. to supply out of the main conduit and out of its water right of 22,500,000 gallons, or more, other cities and towns along the route, until Sept. 24, 1900 (thereafter from works to be built in the meantime), the waste of head or pressure at Belleville reservoir is not without compensating advantages. The greater the head at Belleville, the wider the range of possible future water customers for the company. And after 1900, when the whole works will have passed to the city, the excess of pressure at Belleville may be utilized, by the city if desired, to produce a respectable amount of power; hence, in these days of power transmission, of income.

The Reservoirs.—The storage reservoirs are each formed by earth dams with concrete heart-walls, a layer of large bowlders with gravel washed into the crevices being placed on the upstream face, and of smaller bowlders, some 3 ft. thick, on the downstream face, the latter obviating the trouble and expense of securing a sod on the lower face and also utilizing the large amount of bowlders in the gravel used for the body of the dam, which bowlders had to be disposed of in some way.

As to this method of protecting the lower slope, Mr. Herschel says:

Their use, for the purpose named, has proved entirely satisfactory, and the author is prepared to recommend a repetition of this form of covering for the down-stream side of reservoir dams. It answers every constructive demand, and, as no one has ever, to the author's knowledge, said aught against the appearance of this slope covering, while many have said that it gave the dams a look of great stability, it may be fairly claimed that aesthetic considerations, also, have been fully met by this covering of small boulders.

The gatehouse at the Oak Ridge reservoir is built in a rock cut, but that at the Clinton reservoir has a rock cut bottom, only, the cut being arched over and the dam built to surround the gatehouse. Leaks occurred through the seams in the rock, and in 1892 a layer of concrete was placed on the floor of the ledge channel and its sides lined with brick and cement masonry.

(To be continued.)

STEAM SHOVELS AND STEAM SHOVEL WORK.*

By E. A. Hermann, M. Am. Soc. C. E.

Part II.—Steam Shovel Work.

(Continued from page 519.)

(Correction.—The figure referred to as Fig. 43, in the second paragraph of the third column of p. 519, should be Fig. 42½, which is given below. Figs. 42½ and 43 indicate how an extra cut can often be avoided by slightly changing the alinement of the new main track, and at the same time reducing the degree of curvature.)

In reducing grades on railways with a traffic too heavy to permit loading on the main track, a temporary main track must first be built by one of the methods shown in Figs. 23, 24 and 25. The temporary main track, A, Figs. 44, 45 and 46, is then laid, as shown in Fig. 28, to carry the traffic of the road unobstructed. The main track then becomes the loading track for the first cut, and the following cuts are made as shown in Figs. 44, 45 and 46. The temporary main track, A, is moved to a second position, B, when the material under it must be cut away. Great care should be taken to arrange the cuts so that the temporary main track will have to be moved as few times as possible, and to attain the lowest level when it is moved. In loose gravel or sandy materials wider bermes and longer slopes must be allowed for the shelf on which the temporary main track rests than are shown in the above figures, but the method of doing the work is essentially the same.

Fig. 42½.

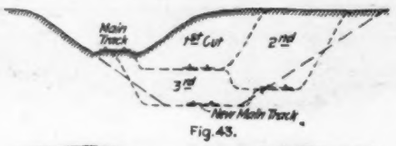


Fig. 43.

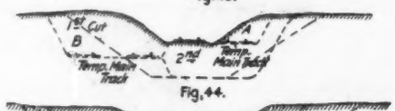


Fig. 44.

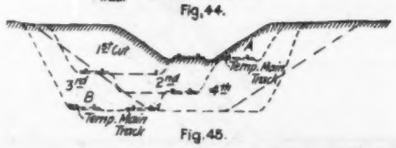


Fig. 45.

Fig. 46.

Fig. 47.

Fig. 48.

apply to all, every case requires disposition according to its own special circumstances. Great care and study should be exercised in arranging the cuts, to reduce them to the fewest possible number, and avoid shifting, taking up and relaying tracks oftener than absolutely necessary.

Construction Work.—On railways the steam shovel is used mostly in connection with maintenance of way work: loading gravel for ballasting track, widening cuts, filling trestles, etc., but it is also largely used for various construction work, particularly re-alinements of the main track for reducing grades and curvature. In excavation of this class, thorough cutting should be avoided if possible, for reasons which will be subsequently explained. The work is begun by laying a temporary track, A, Figs. 50, 51 and 52, over the surface of the ground if its natural grade is not too steep to permit operating construction trains over it. Grades up to 6% (316.8 ft. per mile) can be used. A mogul engine will draw six empty flats over such a grade, a sufficient number of cars to

Fig. 49.

Fig. 50.

Fig. 51.

If the depth of the original cut in tenacious materials exceed the height which the dipper can reach, and break down the material above it, the cuts are arranged as shown in Figs. 47, 48 and 49. Tem-

*Copyright, 1893.

start the work for the short cuts near the summit. The cuts are then made as indicated in Fig. 52.

If the grade of the ground is too steep to operate a track laid on it, one of three methods may be adopted to obtain a grade for this track:

1. The steam shovel is made to cut a trench between the points A and B, Fig. 53, where the slope of the ground is too steep to permit operating a track laid on its surface, and varying in depth from 5 to 10 ft. as may be necessary to attain the desired grade. The excavated material is dumped at D, Fig. 54, to be removed with the next cut. The length of the crane will not permit dumping at E a sufficient distance (20 ft. or more) to obtain a berme and prevent the material washing back into the new cut in the course of time; it must, therefore, be dumped at D and removed as described, unless the slope of the ground is away from the cut, as indicated by the line D F, Fig. 54; in such a case the excavated material can be dumped at F.

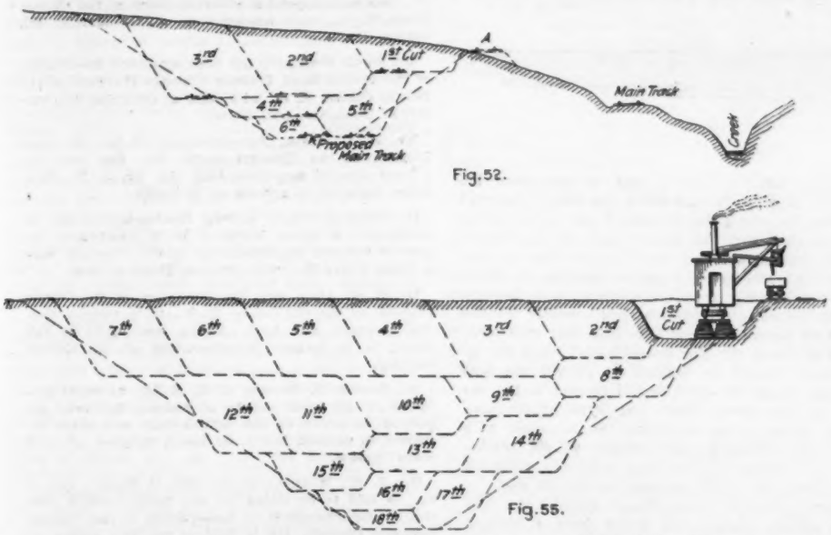


Fig. 52.

Fig. 55.

Fig. 53.

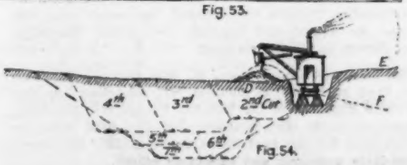


Fig. 54.

2. By excavating the trench with teams and scrapers.

3. By through-cutting a trench with the steam shovel, loading the material on small dump cars or wagons, and wasting it at the nearest available place.

After the first loading track has been laid in this trench, the cuts are made as indicated in Fig. 54.

When the slope of the ground is too steep to permit a track to be laid on it which can be operated, or to cut a trench for it, as frequently occurs when the excavation passes through a high spur or knoll, Figs. 55, 56 and 57, the steam shovel mounted on standard gage railway tracks cannot be used, and a machine independent of a railway track for transportation must be employed. It is started at A, Figs. 56 and 57, loading small dump cars drawn by horses, and dumping at the nearest available place outside of the lines of the new cut, as at D, Figs. 56 and 57. Sometimes wagons are used if the cuts near the top are short and not very deep, so that a temporary standard gage track can soon be run through the cut, and the material loaded on cars. The dumping track at D is changed to E, F, etc., Fig. 57, as the machine cuts lower, maintaining a descending grade from the steam shovel.

In cases of this kind it is often necessary to run the steam shovel up a very steep grade to reach the point where it is to begin work. This can readily be done by attaching one end of a 1½-in. rope to a strong tree and winding the other end around the driving axle. Then starting the running gear the machine can be drawn up grades where it could not otherwise propel itself. As a precautionary measure, it is advisable to use at least two ropes.

A combination of all these methods sometimes becomes necessary, as shown in Figs. 58 and 59.

The material in the knoll, K, Fig. 58, is loaded on small dump cars and unloaded at the nearest available place. When this knoll has been cut down sufficiently, and trenches cut between A B and C D, the track A B C D is built, and the excavation proceeded with, as heretofore described. The high points B, K and C are cut down first until the grade of the loading track between B and C is parallel to the grade of the proposed new main track. Cuts nearly 100 ft. in depth and a mile in length have been excavated in this manner.

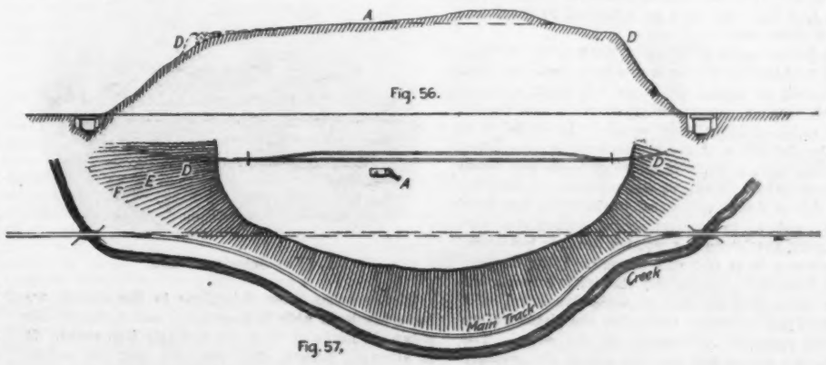


Fig. 57.

Fig. 58.

Fig. 59.

Two and often three steam shovels are employed at the same time, working near the ends of the cut until the through track has been laid, and then following each other, as shown in Fig. 60. As soon as possible, a through track should always be laid, as it greatly increases the capacity for the prompt and efficient handling of the cars.

Enough side tracks for storing both empty and loaded cars should be built close to the work, where they can be reached without going out on the main track. Sometimes the pit tracks behind the steam shovels are utilized for this purpose, but these tracks are taken up too often, and should not be depended upon for side tracks, though they may be used as such occasionally.

In through-cutting the material is loaded on small dump cars running on tracks of about 3 ft. gage, drawn by horses, and wasted on some side hill or other nearest available place; this haul seldom exceeds a quarter of a mile in length. In Fig. 61, the empty dump cars standing at A are drawn over the cross-over C by a horse, to be

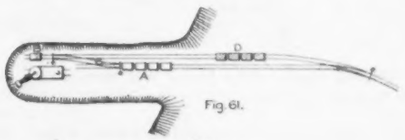


Fig. 61.

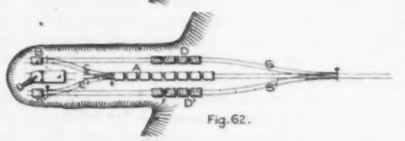


Fig. 62.

loaded at B; then run to D, and when from four to six cars have been loaded they are taken to the dumping place and unloaded; then returned to A.

In loose materials considerable time is lost in waiting from the time the loaded car is run to D and the next empty brought from A to B. In tenacious materials not nearly so much time is lost, as the dipper cannot be filled so rapidly. This loss of time is largely avoided by arranging double loading tracks, Fig. 62, one on each side of the steam shovel, and connected to a central track for empties by the cross-overs C and C' and switches S and S'. Two horses are used, one on each side of the central track, to bring forward the empty cars from A to B, and A to B', and return them to D and D'; these operations are alternately performed, each empty car on one loading track being brought forward, while the other is being loaded. The cross-overs C and C' should be kept close to the rear of the steam shovel, and as it advances they must be taken up and relaid; this becomes necessary about once in three days in soft materials and about once a week in hard stuff.

Portable sections of tracks, switches and crossovers are generally used between the points A and B, and can be relaid very quickly.

Standard gage railway cars cannot be used in thorough cutting, as the track cannot be laid in front of a point at right angles to the post of the steam shovel, and when the track ends there the crane cannot swing back far enough to load the car. Thorough cutting should be avoided if possible, the cost due to the loss of time in switching cars, relaying tracks, extra horses and men, etc., makes it more expensive than excavating from a side cut.

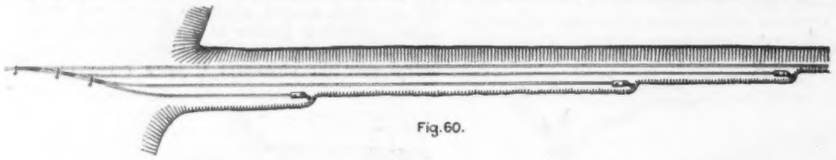


Fig. 60.

In excavating canals, harbor and dockwork, stripping coalfields, stone quarries, grading for new city additions, and other work not connected with a railway, as well as railway construction and realinement work which is inaccessible to a railway track in its early stages, the general manner of using the steam shovel is the same as for railway work; varying only in details, depending upon the means of disposing of the loaded material, by wagons, carts or dump cars, and the use or waste of this material.

(To be continued.)

A NEW FORM OF BRAKE GEAR.

One of the most promising innovations in car construction which has appeared for some time is the substitute for the brake-beam which is being put on the market by the Beamless Brake Co., of Bloomsburg, Pa. The accompanying cut shows the device so well that little explanation is necessary. It consists merely of a curved lever, made of malleable iron, hinged to an extension of the arch bars and connected by a rod to the usual brake levers. Any pattern of brakeshoe or head can be used, and the lever may be attached to the brake rod by either nuts or keys.

The points made in favor of the new device compared with the brake-beam are that accidents from the falling of brake-beams on the track are prevented, these accidents being, as every one knows, quite common in railway service. In addition to this the deflection of the brake-beam is done away with and thus a common cause of inefficient braking is obviated. Many of our readers are familiar with the fact that the metal brake-beam has been largely applied to air-brake cars during the past few years, not because a wooden beam is too weak, but because it is not stiff enough. With the air-brake every bit of slack and elasticity between the brake piston and the shoe is a disadvantage, as it means so much further travel for the piston before the full pressure is exerted on the shoe. The farther the piston travels, the less is the pressure against it; and what is of much more importance, the more the piston has to travel to take up slack, the less is the space available for it to travel to take up wear of the brakeshoe. Apparently the deflection of the device illustrated ought to be considerably less than the deflection of the heaviest and stiffest metal brake-beam.

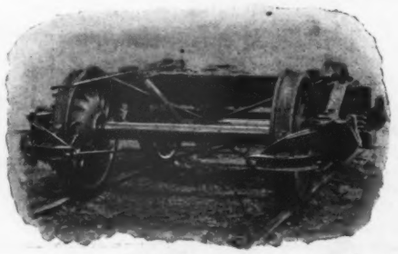
Another feature which should commend the device to favorable consideration is that the brakeshoes are on the outside of the wheels and are easy to reach for inspection, adjustment and repair; and at the same time are supported from the truck, which is generally conceded to be the correct method, and not from the car body. The latter is the great advantage which has been generally conceded to inside hung brakes.

No one will deny that the advantages which we have enumerated are exceedingly important and will effect enough saving to warrant considerable expense to secure them. The curved lever is inexpensive compared with the usual equipment of brake-beam and hangers. The other parts of the brake rigging are practically unchanged. The only increase in expense which is required at any point is the extension of the arch bars of the truck frame to form a fulcrum for the bent lever.

Another and very important advantage which apparently should be realized by this device is that when the brakes are off the shoes will not be tipping over against the wheel, adding to the resistance of the train and causing needless wear on shoes and tires. It should also be possible to wear brakeshoes evenly by this device instead of having many of them go to the scrap heap when the top is worn to an edge and the bottom is hardly half worn out. The chief cause of this unequal wear of shoes hung from brakebeams, is of course the fact that the shoe is free to turn about the hanger as an axis and when the shoe is pressed against the wheel the downward pull of the wheel on the shoe and the upward pull of the hanger on the brakebeam tend to cause the shoe to turn downward, and its top is pressed against the wheel with considerably greater force than is its bottom.

Perhaps many car builders will consider this too great an innovation; and it is true that with some types of truck, the Fox pressed steel truck for instance, it would be difficult to extend the side frames, except by considerable change in the design of the truck. With any type of diamond truck, however, the extension can be made with very little difficulty and expense on old trucks, and new trucks can be built with the extended side frames at a still smaller increase in cost.

It may, perhaps, be questioned whether the shoe being swung against the wheel from a vertical axis will be brought squarely against the wheel. As a matter of fact the lever being pivoted 6 ins. out from the face of the wheel and ½ in. back of the line of the tread, the cone of the tread and the slight motion between the brakeshoe and head bring the shoe squarely against the tread at first, and it wears out evenly.



The Beamless Brake.

If there are other objections to the device, we have not been able to find them, and certainly the points in favor of it are exceedingly important. It is strange, indeed, that the idea has not before been put in practice, for if it were for the first time proposed to apply brakes to a car truck one can see by comparing the brakebeam and hangers with the bent lever arrangement that it seems much more simple and mechanically correct to support the brake from the nearest and strongest abutment, the side frame of the trucks, and carry rods directly to each wheel, than it does to swing a heavy beam across the track and attach the brake rod to its middle.

Although the invention was made only a few months ago (it was patented Feb. 7, 1893, No. 491,381), it has been already put into practical use. A car equipped with it was run for six months on the Bloomsburg & Sullivan R. R., and is now in the Bloomsburg Car Co.'s exhibit at the World's Columbian Exposition. The apparatus is now being applied to all the passenger cars on the Bloomsburg & Sullivan R. R. and is to be put onto cars for the New York, Susquehanna & Western and the Thacher Car & Construction Co.

PERSONALS.

Mr. John Vrey, formerly Village Engineer of West Duluth, Minn., has been appointed Assistant Engineer on the Duluth & Iron Range Ry.

Mr. T. L. Smith, civil engineer of Concord, N. H., died June 1, at the age of 31. He had been engaged on the Boston & Maine R. R. and in the South.

Mr. C. H. Ackert, of the Iowa Central R. R., has been appointed General Manager of the Elgin, Joliet & Eastern R. R., vice Mr. G. O. Clinton, resigned.

Mr. T. W. Tabrum has been appointed Chief Engineer of the Bristol, Elizabethton & North Carolina R. R., vice Mr. G. S. Brice. His office is at Bristol, Tenn.

Mr. O. F. Bedell, Assistant City Engineer of Altoona, Pa., has been appointed Chief Engineer of the Clarion River R. R., with headquarters at St. Mary's, Elk county, Pa.

Mr. Curtis Dougherty has been appointed Roadmaster of the Second Road Division (Chicago Division) of the Illinois Central R. R., with office at Centralia, Ill., vice Mr. E. Donoghue, transferred.

Mr. H. G. Clark, Superintendent of the St. Louis Division of the Missouri Pacific Ry., has been appointed General Superintendent, vice Mr. A. W. Dickinson, resigned on account of ill health.

Mr. Thomas Cronin, General Roadmaster of the International & Great Northern R. R., has been appointed General Superintendent of the Houston, East & West Texas Ry., with office at Houston, Tex.

Mr. E. G. Allen, now Superintendent of the Central Division of the Old Colony R. R., is to become General Manager, and A. L. Ackley, now agent at Fall River, is to become Superintendent of the Central Division.

Mr. Bennet H. Brough, A. R. S. M., assistant professor of the Royal College of Science, has been appointed Secretary of the British Iron and Steel Institute, to succeed Mr. J. S. Jeans, resigned after 16 years' service.

Mr. J. W. Weston, of the firm of Ricker, Lee & Co., is said to be slated for the newly created position of Superintendent of Construction to the Chicago Sanitary District. He is said to be well known as an engineer and contractor.

Mr. Richard Butt, City Surveyor of Brooklyn, N. Y., in 1844, died in that city last week. He was born in England in 1819, and came to the United States in 1841. He served as a military engineer during the war, rising to the rank of major.

Mr. H. C. Landon, Assistant Engineer on the Delaware Division of the New York, Lake Erie & Western R. R., with headquarters at Port Jervis, N. Y., has accepted the appointment of Assistant Engineer on the New York State Canals, with headquarters at Little Falls, N. Y.

Mr. Benezette Williams resigned his position as Engineer-in-Chief of the Sanitary District of Chicago on June 7. His resignation was at once accepted, as considerable friction has existed for some time between the Board and himself. Mr. Isham Randolph was chosen to fill the vacancy.

Mr. John Sterling Deans, M. Am. Soc. C. E., who has been appointed to succeed Mr. Adolphus Bonzano as Chief Engineer of the Phoenix Bridge Co., has been connected with the company for the past fourteen years, and for the past three years as Mr. Bonzano's immediate assistant and executive officer.

Mr. J. P. Heindell, formerly of the Brooklyn, Bath & West End R. R., has been appointed Superintendent of the Pittsburg Division of the Western New York & Pennsylvania R. R., vice Mr. Edwin A. Fisher, resigned to accept an appointment in the engineering department of the Rochester water-works.

Mr. Geo. Cawley, chief editor of "Industries," London, is about to retire from the position which he has held since that paper was started, some seven years ago. The paper has now attained an established position. At the beginning of this year a change occurred in the proprietary, and this led Mr. Cawley to tender his resignation. He will carry on business as consulting engineer at 29 Great George St., Westminster, London.

Mr. George A. Schele, Chief Engineer of the Jirardot Ry. Co.; Mr. J. C. Gebner, Chief of Construction, and Mr. W. O. McKenny and Mr. D. Clark, of that company's service, have arrived at Panama from the United States on their way to join Col. Pennington, the concessionnaire of the Jirardot Ry., who is now engaged in the preliminaries of construction of that road in Colombia.

Mr. Isham Randolph, the new Engineer-in-Chief of the Chicago Sanitary District, was Engineer-in-Charge of the Chicago, Madison & Western Railway, the northern extension of the Illinois Central, and Chief Engineer of the Western Indiana. He was last in charge of the Chicago terminals of the Baltimore & Ohio R. R. He is about 40 years of age, and last year was the President of the Western Society of Civil Engineers.

NEW PUBLICATIONS.

STATISTICS OF THE AMERICAN AND FOREIGN IRON TRADES FOR 1892. Annual Statistical Report of the American Iron and Steel Association, containing complete statistics of the American Iron Trade for 1892, and for Twenty Preceding Years; also, a Brief Review of its Present Conditions; also, the Latest Statistics of the Iron and Steel Industries of Foreign Countries. Philadelphia, May 1, 1893: Published by the Association. Pamphlet; 8vo.; 108 pp.

Much of the detail of this valuable collection of statistics has already been published, but much remains that is of great interest, and that can only be of value to interested parties in its complete form, as presented by this Association. Among its new features, this report for the first time gives the production of iron and steel structural shapes, and the figures given for the year 1892, 453,957 tons, will surprise even those engaged in this industry. Nearly all of these shapes were of steel, and Pennsylvania alone produced 342,644 tons of the total given. Plates and sheets are not included in this sum, and they figure separately at 731,460 tons for iron and steel, not including plates for nails. The production of wire rods, nearly all steel, amounted to 627,829 tons for 1892; an increase of over 90,000 tons over 1891. Cut nails and spikes, excluding railway spikes and others made from bar iron, wire nails and machine-made horseshoe nails, aggregated 4,507,819 kegs of 100 lbs. each; a decrease of about 10% as compared with 1891. The manufacture of cut nails has been steadily decreasing, and in 1892 wire nails, for the first time, exceeded the output of cut nails, with a total of 4,719,524 kegs of 100 lbs. each. This latter industry has grown since 1866, from a total of 600,000 kegs in that year, to the amount given. Iron and steel for shipbuilding were only used in 55 ships, of 51,374 tons, launched in 1892, as compared with 76 ships, of 106,618 tons, for 1891. The much disputed question of the progress of the tinplate industry in the United States is discussed at full length in the report. The returns presented show an increase in the production of both tin and terne plate, ranging from 826,922 lbs. in the quarter July to Oct., 1891, to 19,756,491 lbs. from Oct., 1892, to Jan. 1, 1893. And of the total in the last quarter given, over 40% was made from American black plates, showing that much progress has been made in the last two years in the establishment of American mills for rolling black plates, an industry which did not exist prior to 1891. The general status of the principal several other industries here treated in full may be most concisely put in the form of a table showing the progress in the United States for several years past:

	1890.	1891.	1892.
Iron ore produced tons	16,036,043	14,591,178	.....
Imports of iron ore, tons	1,246,830	912,856	806,585
Pig iron, produced, tons	.....	8,279,870	9,157,000
Bessemer steel ingots, tons	3,688,871	3,247,417	4,168,435
Open-hearth steel, tons	513,232	579,753	660,889
Crucible steel, tons..	71,175	72,586	84,709
Iron and steel rails..	1,885,307	1,307,176	1,551,844
Bessemer steel rails	.....	1,293,053	1,537,588
Value of imports of iron and steel.....	.....	$41,083,626	$33,882,447
Value of exports of same	.....	$30,736,507	$27,900,862
Miles new railway..	.....	4,471	4,407
Total miles railway..	.....	170,601	175,008
Coal production, tons	140,882,729	150,505,954	.....

If a similar table is made from the data given for the statistics of the foreign trade, we would have the following for the United Kingdom:

	1890. Tons.	1891. Tons.	1892. Tons.
Coal produced.....	181,614,288	185,479,126	181,786,871
Iron ore produced...	13,780,767	12,777,689	.....
Iron ore imported....	4,471,790	3,180,543	3,780,503
Pig iron produced....	7,904,214	7,406,064	6,616,890
Bessemer steel ingots	2,014,843	1,642,005	1,500,810
Bessemer steel rails.	1,019,606	662,676	535,836
Open-hearth steel...	1,564,200	1,514,538	1,418,830
Exports of iron and steel	4,001,430	3,240,146	2,740,217

WORLD'S COLUMBIAN EXPOSITION—Souvenir Map of—at Jackson Park, Chicago, including the Midway Plaisance, 1893. Compiled and drawn from Actual, Official Data. By Hermann Heinze, Chief Draftsman Surveys and Grades Department, World's Columbian Exposition. Main Publication Office, 1113 Masonic Temple, Chicago, Ill. Colored 25 cts.

This may be called the reliable map of the Exposition grounds and buildings, as it is made by one who was intimately and personally associated with the laying out of all roads and streets and the location of all buildings connected with the Fair. The smallest detail, as far as buildings are concerned, seems to have a place on this map, and in a letter published in the Chicago "Despatch" the compiler compares it with other and the "official" maps, and points out in these a long list of omissions and mistakes in location. The colored map especially makes everything plain to the eye, and the only criticism that we would make is that the lettering on some of the locations should have been larger, even at the expense of the general appearance of the map. It has evidently been too much reduced from a large map.

TRADE PUBLICATIONS.

LOCOMOTIVES.—Brooks Locomotive Works, Dunkirk, N. Y. 8vo; oblong; cloth; pp. 30; illustrated.

The Brooks Locomotive Works have an interesting exhibit at the World's Columbian Exposition, consisting of nine engines of different types, which are illustrated and described in this pamphlet. In another column we give particulars of these engines, and also of the Brooks engine for the "Exposition Flyer" express train.

STEAM ROLLERS.—O. S. Kelly Co., Springfield, O. 4to; pp. 16; illustrated.

This is a handsome descriptive catalogue of the company's steam road rollers (Eng. News, Nov. 21, 1891) and asphalt rollers (Eng. News, Nov. 24, 1892), with dimensions and particulars of construction. There is also a reprint of Mr. Isaac B. Potter's illustrated article on "Our Common Roads," from the April "Century Magazine." A colored frontispiece represents six of the rollers at work making the roadways of the World's Columbian Exposition.

THE WORCESTER DRILL GRINDER. The Washburn shops of the Worcester Polytechnic Institute, manufacturers. Pamph.; pp. 20; illustrated.

The Worcester Polytechnic Institute is, we believe, the only technical school whose students' shopwork is utilized in the manufacture of machinery for the market. It speaks well for the work done by the students that a machine so accurate as a twist drill grinder is turned out by them. The fact that the machine is in use by such firms as Pratt & Whitney and Brown & Sharpe, and that over 600 have been sold, is good evidence of its merits.

SOCIETY PROCEEDINGS.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—The regular meeting was held June 7, Mr. Chas. B. Brush in the chair, Capt. W. H. Jaques, engineer of ordnance for the Bethlehem Iron Works, read a paper on "The Manufacture of High Power Ordnance, with Special Reference to the Wire-Wrapped Gun." He referred to the explosives used, and stated that nitrocompound smokeless powder and "cordite" appear to be the most promising. The macaroni type of smokeless powder is adopted in this country. The built-up type of gun is now the most favored, because we know more about it, and how to make it a successful machine, but it may be superseded by other types. Although Krupp and some Russian ordnance works use crucible steel, in this country open-hearth steel is used exclusively, with the Whitworth system of fluid compression in the ingot molds. Treatment in the oil bath and annealing in the furnace are both necessary, and a gas annealing furnace is best. A great trouble with cannon is to prevent the erosion of the bore by the products of combustion, and the amount of work done on the metal has a greater influence in giving it a quality to resist erosion than has the chemical composition, although the latter must not be overlooked. It is possible that some new explosive may be introduced whose products of combustion will be less destructive. The failure of the English 110-ton gun was attributed to mechanical causes only (mainly the use of too many small hoops in the manufacture), and these large guns are necessary on account of their shattering power on heavy armor. Reference was made to nickel-steel for guns and armor, and for the former it has the advantage of being practically noncorrodible when rich in nickel. Wire-wound guns were referred to at some length, and various systems described, including the Longridge, Woodbridge and Brown. An objection urged against the Brown segmental wire-wound gun, illustrated and described in our issue of Nov. 24, 1892, is that the edges of the longitudinal segments forming the bore may offer a chance for erosion to begin from the effects of the products of combustion.

The lecture was listened to with much interest and was illustrated by numerous stereopticon views representing various guns and the methods of manufacture of modern ordnance at the Bethlehem Iron Works. A Holtzer solid conical shot that had been fired against an armor plate without injury was exhibited, as well as several interesting samples of Canadian nickel ore and samples of nickel matte made by the Orford Copper Co.

At the meeting on June 21 a paper on "The Erosion of the Banks of the Mississippi River" will be presented. The following candidates were declared elected:

Members—Albert S. Cheever, Chf. Engr. Fitchburg R. R.; Richard Evans, Jamaica, N. Y.; Theodore G. Hoech, technical attache German Legation, Washington, D. C.; Geo. H. Hutchinson, Keystone Bridge Co., Pittsburg, Pa.; Walter McCulloh, New Croton Aqueduct, Brewster's, N. Y.; Elwood Mead, State Engineer, Cheyenne, Wyo.; C. P. E. Swenson, Keystone Bridge Works, Pittsburg, Pa.; Robert A. Way, London, Eng.; E. A. Ziffer, Vienna, Austria.

Associate Members—W. F. Behrens, Albuquerque, N. M.; C. R. Bettes, Hoboken, N. J.; R. K. Brown, Asst. Engr., P., C., C., St. L. Ry., Pittsburg, Pa.; A. P. Davis, U. S Geological Survey, Los Angeles, Cal; A. P. Folwell, Atlantic Highlands, N. J.; A. Perrillat, Mem. of Bd. of State Engrs., New Orleans, La.; G. H. Vedeler, Asst. Engr. N. Y., N. H. & H. R. R.

NEW ENGLAND WATER-WORKS ASSOCIATION.—The twelfth annual meeting of the association opened at Worcester on Wednesday of this week. Some of the papers presented at the meeting are abstracted elsewhere in this issue, and a full report of the convention will appear next week.

MASTER MECHANICS' ASSOCIATION. — The twenty-sixth annual convention will be opened at Lakewood, N. J., at 9 a. m., on June 19. The following are the subjects on which reports of committees are to be submitted: (1) Exhaust Nozzles and Steam Passages. (2) Standard Tests for Locomotives. (3) Compound Locomotives. (4) Tests of Steel and Iron. (5) Uniform Locomotive Performance Sheets. (6) Standard Diameter for Wheel Centers and Tires. (7) Boiler Attachments. (8) Malleable Iron Castings. (9) Attachments between Engine and Tender. (10) Smoke Prevention. (11) Tender Frames.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—The summer meeting this year is to be held at Section B of Mechanical Engineering in the World's Congress of Engineering at Chicago. Sessions will begin Monday morning, July 31, and will continue during the week, closing Aug. 5. The afternoons are to be left free for visits to the Fair and for social or other purposes.

A circular has been issued inviting papers on methods of manipulation and manufacture, to be read before the society, to be accompanied where possible by samples showing the successive stages of the process and accompanied by statements of the cost of materials and labor. These samples it is proposed to keep on exhibition at the society's house.

The committee in charge of the Bureau of Information for the use of foreign engineers and others who may call at the society's house this summer on their way to and from Chicago, proposes to arrange trade catalogues and photographs for the use of guests, and invites manufacturers to forward copies of their trade publications for that purpose. Such catalogues should be addressed to the Secretary, Prof. Hutton, at 12 West 31st St.

COMING TECHNICAL MEETINGS.

ENGINEERS' CLUB OF PHILADELPHIA.
June 17. 1122 Girard St. Secy., L. F. Rondinella.
SWEDISH ENGINEERS' CLUB.
June 17. Secy., P. Valentine. At 281 Union St., Brooklyn, and 646 North 10th St., Philadelphia. At 180 La Salle St., Chicago. Secy., John Ericson.
AMERICAN RAILWAY MASTER MECHANICS' ASSOCN.
June 19. Lakewood, N. Y. Secy, Angus Sinclair, New York.
COLUMBIAN ENGINEERING SOCIETY.
June 20. Secy., F. W. Hart, Washington, D. C.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
June 20. Secy., R. H. Clark, Pittsburg.
BOSTON SOCIETY OF CIVIL ENGINEERS.
June 21. Secy., S. E. Tinkham, 36 Broomfield St.
ENGINEERS' CLUB OF ST. LOUIS.
June 21. Secy., Arthur Thacher, Odd Fellows' Building.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
June 21. Secy., F. Collingwood, 127 East 23d St., New York.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
June 23. Secy., C. H. McLeod, Montreal, P. Q.
DENVER SOCIETY OF CIVIL ENGINEERS.
June 27. Secy., F. E. King, Jacobson Block.
WESTERN SOCIETY OF ENGINEERS.
July 5. Secy., Jno. W. Weston, 51 Lakeside Bldg., Chicago.
ENGINEERS' CLUB OF MINNEAPOLIS.
July 6. Secy., E. Nexsen, 504 Kasota Block.
ASSOCIATION OF CIVIL ENGINEERS OF DALLAS.
July 7. Secy., E. K. Smoot, 808 Commerce St.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
July 7. Secy., O. Von Geldern, 719 Market St., San Francisco.
MONTANA SOCIETY OF CIVIL ENGINEERS.
July 8. Secy., G. O. Foss, Helena.
ENGINEERS' CLUB OF KANSAS CITY.
July 10. Secy., Waterman Stone, Baird Building.
WISCONSIN POLYTECHNIC SOCIETY.
July 10. Secy., M. F. Schinke, City Hall.
ATLANTA SOCIETY OF CIVIL ENGINEERS.
July 11. Secy., Parker M. Black, Capitol Block, Atlanta, Ga.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
July 11. Secy., F. C. Osborn, Case Library Bldg.
NORTHWEST RAILROAD CLUB.
July 11. Ryan Hotel, St. Paul. Secy., W. D. Crosman.
NORTHWESTERN SOCIETY OF ENGINEERS.
July 11. Secy., D. W. McMorris, Burke Block, Seattle, Wash.
CIVIL ENGINEERS' ASSOCIATION OF KANSAS.
July 12. Wichita, Kan.
ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
July 13. Secy., F. W. Mowbray, Norton Building.
ENGINEERING ASSOCIATION OF THE SOUTH.
July 13. Secy., W. G. Kirkpatrick, Nashville, Tenn.
TACOMA SOCIETY OF ENGINEERS AND ARCHITECTS.
July 14. 201 Washington Building.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
July 14. Secy., D. W. Meeker, St. Paul.
NEW YORK RAILROAD CLUB.
July 20. Secy., H. G. Prout, 73 Broadway N. Y.
ENGINEERS' CLUB OF CINCINNATI.
July 20. Secy., J. F. Wilson, 24 W. 4th St.
SCANDINAVIAN ENGINEERING SOCIETY OF CHICAGO.
July 20. Secy., C. F. Franson, Portland Block.
ENGINEERS' SOCIETY OF PHŒNIXVILLE.
Sept. 5. Secy., W. Halliburton.
NEW ENGLAND RAILROAD CLUB.
Sept. 12. Secy. F. M. Curtis, C. C. R. R., Boston.
WESTERN RAILWAY CLUB.
Sept. 19. Secy., Clement F. Street, Chicago.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Sept. 20. Secy., L. V. Carmait, Roanoke, Va.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Sept. 21. Secy., S. A. Charpiot, Macon, Ga.
CENTRAL RAILWAY CLUB.
Sept. 27. Secy., S. W. Spear, Buffalo, N. Y.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Oct. 2. Secy., C. L. Annan, City Engineer's Office.

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ADVERTISING RATES: 20 cents per line agate measure. Schedule sent on request. Changes of advertisements must be in hand on Monday afternoon; new advertisements, Tuesday afternoon; transient advertisements, not later than Wednesday noon. The last pages go to press early on Thursday. We shall be obliged if subscribers who fail to receive their papers promptly will notify us without delay.

The question of the relations between the track of a railway and the train loads and train service which it carries, is an important one in railway operation and economics, but its importance does not appear to be so well recognized as it should be in the interests of safe and economic operation. In another column we print a paper on this subject, in which it is shown that the train service is arranged with little regard to the condition of track. We certainly hear frequently of the use of heavier rails, but still more frequently of elaborate and handsome cars and ponderous locomotives, many of which, it is safe to say, run over tracks which are positively dangerous. It is not merely the weight of rail and quality of first construction of the track, but largely the maintenance of track, which enter into this question, for on how many of our best lines may be found inferior ties and loose spikes and bolts? The railway exhibits at the World's Columbian Exposition include a number of handsome cars with very elaborate and expensive decoration and finish, and the character of this exhibit suggests again that an unreasonable amount of money is expended on such cars as compared with the money expended on the track. We, of course, take into consideration the excellent character of track of many leading railways, but on the whole the train equipment is largely out of proportion to the track equipment. Instances illustrating this are given in the paper, and another instance is afforded by the recent accident on the Central Vermont R. R., noted by a correspondent in our issue of June 8, where the old and unsafe stub switch added another derailment to its already extensive record. This particular accident occurred on a line having a heavy passenger traffic, and it is one of the many cases illustrating the dangerous discrepancy which exists in the relations of track to train service to which we have above alluded. The question is one which calls for the attention of directors and executive officers, and it will be considered incidentally next week at the Railway Congress, at Chicago, in an address by Col. H. S. Haines, President of the American Railway Association, on "Railway Accidents, Their Causes and Remedies."

The resignation of all but one of the New York Rapid Transit Commission leaves the citizens of New York just where they were in 1891, as far as improved rapid transit is concerned. About two years of time and about $200,000 have been spent literally for nothing, except the expression from the majority of the commission that the only way out of the difficulty is to accept thankfully such terms as the Manhattan company may see fit to impose. The late commission was made up of successful business men; but judging from methods and results the business of establishing rapid transit in New York did not fall within the line of their previous experience. What the next commission will be made of—business men or politicians—the citizen cannot yet say; but it is to be sincerely hoped that a level-headed, competent civil engineer will be included somewhere in the list. The whole subject of underground, elevated and sunken types of construction should be gone over again, on very different lines from those followed by the late commission, before the public can be made to believe that the extension of a system devised and built years ago is the best that can be adopted now.

The fight between striking quarrymen and laborers on the Chicago drainage canal, on June 9, calls for some comment. As near as the facts of the case can now be arrived at work had lately been suspended at the quarries, at Lemont and Romeo, and a large body of men, mainly Poles, had been discharged. These men naturally looked for other employment and the drainage canal offered the nearest work available. But the canal had already attracted a great many men from other quarters, including many negroes, and the pay and hours of work accepted by this imported labor did not suit the quarrymen. Fired by bad whisky and by what they regarded as an infringement upon their rights, the discharged employees of Lemont and Romeo undertook to drive off the men at work on the canal, with the result that several men of the attacking party were killed and several of the score wounded will surely die.

Factional fights between bodies of laborers on public works have occurred ever since the building of canals and railways in the United States had a beginning, and probably will continue to the end. But for the good-natured, fighting Irishmen of the earlier days, with their heads as hard as their shillalahs, we now have Italians and Poles, an altogether different class of men. These men, as a rule, represent the lowest of their races, the most ignorant and the most unreasoning. Attracted only by what is to them phenomenally high pay, they come here with no desire to become citizens; they speak a foreign tongue and are densely ignorant of the institutions of our government and the rights of our people. Under these conditions they are always ready to be led into mischief by designing men, or by the more ambitious or corrupt among themselves, and when their will is opposed they resort to the pistol or the knife, in defiance of our laws and in accordance only with their own notion that might makes right.

With the growth of our country and the increase in large public works demanding the services of great bodies of men the number of this evidently objectionable class of laborers increases yearly. Resident labor is apparently better employed, and the old-time sources of supply in Ireland, England and Scotland utterly fail to meet the present demand. We must have the labor, and as laborers the Italians and Poles usually work well enough; the problem yet unsolved is how to handle them and prevent outbreaks of the kind here referred to. With men of the class above described there seems to be but one course open, and that is to force them to understand and to respect the rights of other laborers and the employers of labor by a firm and decided application of the strong hand of the law. The neighborhood of great public works attracting a rough class of men generally should be well policed; not only for the avoidance of trouble upon the work and delay in the progress of what may be essential to the health and comfort of millions of citizens, but also for the better protection of those who are compelled to reside near by. When legislation is necessary laws should be framed calculated to meet the conditions of such a case, and these laws should take into consideration the fact that the employer of labor is quite as much entitled to protection as labor itself. The over-ruling law of supply and demand regulates the price of all commodities, labor included; and any exceptions to this law to be valid must be based upon legislation and not upon an exhibition of brute force. No well regulated community can permit the latter to rule, and it owes it to its law-abiding members to suppress it firmly wherever and however it appears.

AIR BRAKES IN THE LAFAYETTE ACCIDENT.

Since our issue of May 25, in which we discussed the circumstances attending the railway disaster at Lafayette, Ind., on May 5, we have received from the Westinghouse Air Brake Co. a copy of the report of its representative who investigated that accident. This report differs in several important particulars from that given in our issue of May 25. It appears that a stop was made at Templeton for water, which is not down on the schedule. In stopping here the train ran half a car length too far, and when the engineer backed up he applied the emergency brake so as to stop at just the right point. Templeton is 18½ miles (37 minutes' run) from Lafayette. The above is proof positive that at this point the brakes must have been in perfect working order, and they must have been fully charged before leaving Templeton, as otherwise they would not have released.

In the second place, it appears that the engineer did not whistle for brakes as the train approached Lafayette until about the time he reached the foot of the grade, and was only a quarter of a mile from the 20° curve where derailment occurred. With this new evidence there is no longer any reason for surprise at the failure to apply the hand brakes. Had the train been equipped with a full force of hand brakemen, and all on the alert, the 20 or 30 seconds before the engine struck the curve which threw it from the track were too little to make the hand brakes of any avail.

On the other hand, at the foot of the grade, when the whistle signal was given, the distance of 1,370 ft. which the train still had to run was ample to have checked its speed sufficiently for it to have passed the curve in safety, provided the brake reservoirs were charged with air and the brakes were applied.

There are two strong reasons for believing the reservoirs to have been fully charged with air. In the first place, as noted above, they were so charged 37 minutes before at Templeton. In the second place, it is stated that an hour and a half after the accident occurred a ten-wheel freight locomotive tried to pull back the three Wagner sleepers at the rear of the train which had remained on the track; but the brakeshoes were still pressed against the wheels on these cars so strongly that the brakes on two had to be released by bleeding before the locomotive could start them. The position in which the triple valve pistons were found on the cars which were off the track also indicated that the brakes on these cars had gone on.

If we admit, then, that the brakes were charged at the time the foot of the grade was reached, why were they not applied and the train saved?

Concerning the application of the brakes by the conductor's valve, both the baggageman and conductor claim to have opened valves in response to the whistle signal. But the facts which speak louder than words are that the valve the conductor claims to have opened was found closed. The valve which the brakeman claims to have opened was found with the handle bent the wrong way and the valve partially open. Had either of these valves been opened at once in response for call for brakes, the train would certainly have been saved, if we admit, as before, that the air pressure was there to do its work. The reasons why these valves were not opened appear to be that neither conductor nor brakeman knew how to open them; or, if they knew, they did not act on their knowledge. The valve handle should be pushed up to open the valve, whereas the natural thing is to pull it down. This is evidently what the brakeman did, and he probably pushed it up and opened the valve partially, too late to check the train. Why the conductor failed to open his valve, one can only conjecture.

The very evident moral of the above is that the conductor's valve, like any other apparatus designed for use in an emergency, ought to be so made that it can either be opened by turning the handle in either direction, or can be turned, in only

one direction, so that anyone going to turn the valve could have no possible doubt what to do, and no cause for either hesitation or mistake. The conductor's valve is like the Texan's revolver; you don't want it often, but when you do want it you want it mighty bad. Probably not one trainman in a dozen has ever had occasion to open a conductors' valve, and we venture to say that a pretty large percentage could not tell offhand which way to move the handle to do it. There is the more reason, therefore, for making sure that such fatal mistakes as that at Lafayette shall not be made.

The only question remaining is why the engineer did not apply the brakes himself. It is barely possible that he did apply them before giving the whistle signal, but that he had reached so high a speed in his run down the grade that the train was not slowed down in time. On the other hand, with the exception of one car, this train was equipped throughout with the quick-action brake, with heavy brake gear and metal brakebeams. It is difficult to believe that any such speed could have been attained in the run down the grade that the brakes would not have slowed down the train to a moderate speed in the quarter of a mile or more between the whistle call and the point of derailment. The speed at the point where the train left the track must have been quite high, probably above 25 or 30 miles per hour, or the train would not have left the track and the wreck when it did leave it would have been less serious.

The most plausible theory seems to be that a trainpipe cock was closed, either by one of the tramps who was put off the train at Templeton, or, perhaps, by a flying missile striking the cock handle on the rear end of the second car, which had the slow-action brake and the old-fashioned cocks. If this latter was the case, then the engineer had only his driver brake and the brakes on the tender and first two cars with which to hold the train. He might have done this easily had he kept the train under control, but if he let it run down the hill, gradually accelerating until a speed of 60 to 80 miles per hour was reached, it might well have been the case that he applied the brake at a distance of only 1,200 to 2,000 ft. from the curve and yet was unable to check the speed sufficiently to round the curve safely. As evidence that he was relying on his driver brake, it is stated that the position in which the reverse lever was found indicates that the engine was not reversed before the derailment, as has been stated. The flying sparks from the driver brakeshoes were probably what gave rise to the report that the engine was reversed before the accident.

As a whole the accident appears from all the evidence to be one of the most remarkable combinations of unusual circumstances that has ever been recorded. The closing of a trainpipe cock by either accident or malice is one of the rarest of occurrences, yet with a cock closed anywhere back of the tender the engineer could have held his train on the grade with the driver and tender brakes alone if he had not been extraordinarily careless in allowing the train to run at unsafe speed down a long grade with a station and 20° curve near its foot. Even then no harm whatever would have resulted had anyone of the trainmen or passengers given a single push upward on the lever of the conductor's valve in any of the cars in response to the thrice repeated call for brakes. But the two trainmen who attempted this both failed, and apparently the brakes were not fully applied to the whole train until the hose was broken in the wreck.

In our previous discussion of the accident, we pointed out that a chief lesson to be learned from it was the small reliance which can be placed on the handbrake in emergencies. The new facts reported above lend additional force to this conclusion, and show that even on a train in the daytime, with the trainmen awake and alert, there is small chance of saving a fast express train from accident by the use of the handbrakes if the engineer delays the call for them until all the power of the air brakes is needed to make the stop. In this matter we can take no steps backward, and it must be realized that the air brake is not alone the main but the only reliance. The need for so mounting conductors' valves that no mistake can be made in their use is a lesson which has never before been so forcibly taught, and it is to be hoped that it may be heeded.

THE IDEAL ENGINEERING SCHOOL.

VI.

Coming now to the details of the course, we have already seen that the total time devoted to theorectical mathematics at our engineering schools, ranging from one-fifth to one-eighth of the total time in weeks, is much less than is ordinarily supposed, and can by no means be considered excessive. The most which may be said is that some colleges devote too much time to elementary mathematical instruction which might better be covered by the demands for admission, but this is in part merely temporary, and in part unavoidable.

This general criticism is almost universally true, however. While the general mathematical training is nearly right, both in quantity and quality, there is an inadequate recognition of the fact that the engineer's need for a complete working MASTERY of elementary mathematics is not paralleled in any other kind of professional education, and is not fully met. To all other men mathematics are either a mere form of mental training, not expected to be used practically, or (as in the case of astronomers or actuaries) a constantly used tool which is kept bright by use. The engineer needs a certain complete familiarity with a few elementary processes which will enable him to use them as he does the multiplication table, with perfect ease at any time. Indeed, the training as to the use of the multiplication table itself is inadequate to make the young graduate what he should be at graduation, an excellent computer.

To this end more practical exercises are needed in these simple processes, which can be done best and with least mental fatigue in combination with field training or its equivalent in the time now lost in vacations, as we have already seen in part. To this end the ideal distribution of time, in our judgment, for civil and mining engineers, especially, but in large degree for all engineers, is eight months of chiefly studious classroom work, varied with occasional fieldwork, about as is now usual; three months of field and camp exercises, accompanied and varied by a very considerable amount of routine computing work for the solution of actual problems developed in the fieldwork (so far as possible) which would be so much clear gain, and one month only of absolutely idle vacation. This three months of additional and chiefly out-door exercises, though it would fully double the value of the year's work to the average student, may easily be so managed that it is in no sense a burden or an additional strain upon the mind of the student, but, on the contrary, is valued by him as the most pleasurable as well as the most profitable part of the year's work, and also the least expensive. Once established at any otherwise good school it would prove an immense drawing card, and would carry that school past its older and larger rivals which had no such feature as if they were standing still. Some details of this work we shall consider in our next and closing article; in the meantime we will only note the general fact to which all those who can speak from experience will testify, that the most delightful, invigorating and enjoyable experience which falls to the lot of the engineer is that combination of vigorous exercise of mind and body which comes from camp life in the field. Camp life in itself, merely for its own sake, soon palls upon the modern man. Camp life with a purpose and accompanied by constant use of the intellectual faculties, and by a certain military exactitude of routine to a common end, soon fills every member of the party from the axemen up with an interest and zeal which in actual fact enables them to do cheerfully more work in a day than any other class of men whatsoever. Much depends upon the chief of party, but under a good chief any such party will cheerfully work harder than they ought, viz., from sunrise to sunset in the field, and in the evenings and on rainy days carry along the office work simultaneously.

It is in the three months chiefly devoted to this kind of work that a permanent and complete mastery of elementary mathematical processes, such as is not now given, should be acquired, but this aim once duly recognized, more would be done toward it than now is done, probably, in the eight months of more purely studious work.

To illustrate the distinction which we draw between mastering and simply "going through" a subject, let the reader take in imagination a sheet of paper and dot it all over at random with points. These points may represent the innumerable isolated facts, formulas and principles which the ideal engineer needs to know about. Let him now start from the bottom of sheet and try to connect all these points by random lines, passing through as many of these points as possible while yet preserving a general upward direction. These lines will represent the several "courses" of the college, and when some line has been passed through all these points, the student has "gone through" all of them in college parlance, and the course is complete.

This is well. This is all that can be done for the most part in any 48 months. But between thus "going through" a point when approached from one direction under guidance and knowing what it is and how to get at it when approached sidewise, and downward and from behind a fence and in all other possible ways, there is a vast distinction. This kind of mastery of advanced subjects is the work of after life, and the average mind can thus master but few subjects; but there is an alphabet of engineering, so to speak, which every future engineer needs to master, and to master early if at all. Therefore there should be a special effort in turn made to have the college course include a mastery of a few of the lower points referred to, by approaching and recurring to them from so many directions that the future engineer may forever after be able to reach and use them from whatever direction and through whatever obstacles. Thus a solid foundation is laid on which it is much easier to build later,

Among such points in the mathematical line are ordinary arithmetical and algebraic computing work, elementary geometrical work (actual curve problems in the field are excellent for this); elementary trigonometric work and the use of logarithms. Others of a semi-mathematical nature are quick field-drafting and lettering. Others in elementary analytical geometry and even the calculus are easily improvised in connection with field exercises in surveying and hydraulic work, and the designing of structures.

All these points the student should either become a thorough master of, as many men would in the 12 months gained to be wholly devoted to this end and to field or shop practice under our suggestion, or (what is almost as useful and important to the young engineer) should have his coefficient of deficiency in each clearly brought out before him. This would occur under our scheme at four successive periods in his college course, and thus each deficient man would be spurred to effort while there was yet time. Moreover, all his advance work in his succeeding years would be made easier by this drill in the elements which would occur at the end of his first and all succeeding years. In fact, we would even go further, and advise that the students who chose to do so (and nearly all would if they had the chance) should enter in June instead of October, and that their first college work should be three months of junior service in these field parties as axemen and chainmen.

An immense intellectual and physical stimulus would thus be given to our engineering students. It would take away the reproach to them that they are impractical, which is a just reproach for which they are not to blame, but which arises solely from the fact that the course laid out for them is too purely scholastic even for the best scholastic work. We will not go over the ground again by pointing out that this is probably (almost certainly) due to the fact that their courses are laid out by men who are not themselves engineers, and who copy too closely the precedents of the older "learned" professors in which they have been trained, but such we believe to be the fact. Time, and time only, will correct this evil, by enabling better methods to crystallize. We are only trying in these articles to hasten the process.

To mention only one more partirular in which a practical mastery of useful tricks of the trade is needlessly subordinated to purely scholastic ends. All our graduates, with rare exceptions, come out poor and slow letterers. We have been especially struck by this fact in examining much college work lately. Simply by requiring that all written exercises during the course should have lettered titles and sub-titles, and pointing out to each student from time to time the defects of his lettering, a

thorough mastery of ordinary quick lettering might be given to almost all of them. It would be an immense benefit to them, gained without taking an hour from the time devoted to scholastic work. It should be expressely forbidden for the student to take any sensible time for this work. He should be forbidden, for example, to draw any lines to guide his lettering or to re-touch the letters or labor over them. He should not be "marked" in this work. Quick, off-hand work on which no great stress was laid should alone be permitted, but by the steady practice of four years in this off-hand work the dullest man would acquire much skill in it.

That so simple and palpable an opportunity as this to gain something gratis should be so neglected will make our belief more reasonable that in like manner more drill in all kinds of elementary routine might be combined with the purely scholastic work without loss to the latter, and generally with gain to it. We will not otherwise discuss this point, nor will we assert it "with circumstance."

It is a notable fact that in pure mathematics the college textbooks used are generally advanced and complete treatises with most of which the engineering student has nothing to do. Only the professional mathematician needs or uses all the contents of these treatises. As mathematics is a rigidly logical, step-by-step process, there is no possible advantage to the student in having more of trigonometry, for example, put before him than he is expected to use and study in his course. He can advance from where he left off, if he needs to, at any time. Nevertheless, he generally does have a good deal more than he thus uses before him in his textbooks.

Coming now to the instruction in the applied sciences, in physics, in engineering construction and economics, in strength of materials and the like, it is notable that precisely the opposite conditions prevail. The engineer's conclusions on these matters are not reached by logical step-by-step methods from simple premises, but by reconciling and striking a balance between a multitude of conflicting and dubious premises, which are continually changing and which can hardly be all known to any one. The difficulty is to determine what the premises are, not to draw the conclusion from them. On these subjects it is obvious that the great need of the engineer is to know where to find knowledge, all that is known and of record on some particular point; to realize how broad each subject is, and how much diversity of practice and conflict of opinion exists on them.

And yet it is precisely on these subjects that the prevailing method of instruction is to prepare lithographed or blueprinted "courses," giving a compendium of what it is proposed to teach the student on those subjects and nothing outside of it. We realize how much there is to be said in favor of this practice, which extends also to most of the printed textbooks prepared for college use, as well as to the manuscripts referred to special to each college. We realize that this practice is adopted as a choice between two evils, in despair of teaching any of these vast subjects thoroughly, and with the idea that it will be better to ground the student thoroughly on certain elements, and confine his attention to these.

The argument is plausible, and to a certain extent sound, but in the extreme to which it is pushed at least we believe that it is injurious. Rather, the student should be compelled to do in college what he will be compelled to do in real life—dig for himself his stumbling and dubious way through a multitude of conflicting opinions and statements to the meat of the special problem before him. In this way, if he did not cover so much ground in the way of superficial acquired knowledge, he would at least learn better how to think and to work in these subjects as he will have to do later, without other guidance than his own brains and judgment.

We chance to have before us, for example, a college course on "The Constructive Materials of Engineering," by Prof. A. W. Smith, of the Leland Stanford Junior University. It is a good little treatise, well and intelligently prepared to get as much useful elementary knowledge as possible on that vast subject into 74 duodecimo pages with 25 lithographed plates. But what is the real use of such intellectual pemmican, such royal roads to a little knowledge? The volume closes with a bibliography of 19 works, the more important of which could all be purchased for about $30. Would it not be vastly better in the end for these students if they were simply given this bibliography, and so far as able made to purchase them, and then made to dig out and prepare for themselves a 74-page abstract of human knowledge on the "constructive materials of engineering"? They would not do it so well. Possibly they might not (and possibly they might) stand so good an examination in the course after "going through" it; but surely they would know what they did know better, and know vastly more how to handle practical problems in a practical way than they do now.

As another practical example, as to which the writer feels that he can speak with some knowledge: He chances to be the author of a bulky volume of 1,000 pages on the economics of railway location. It has been suggested to him by he does not know how many professors, certainly by six or eight, that a compendium or abridgment would adapt the work better "for college use." While he remains in his right mind and his present mind he will never do it, because he believes that he should thus be smoothing the path toward an extremely bad way of teaching that or any other like subject. In all such subjects, if the student learns nothing else, he should at least learn and be forced to learn how many-sided the subject is; how many limitations and exceptions and allowances have to be made; how much work he may need to do to post himself thoroughly on any particular department of the subject. This much once thoroughly learned, it matters little how much definite knowledge he acquires on the subject which he can be examined in. It matters a good deal that he should get a kind of a working grasp on any such subject by having examined for himself the ground it covers. To this end the best of all possible college drills in such a subject is that the student should be compelled to make his own compendium, by original investigation of the best existing sources of knowledge, and the poorest of all drills (poorer, perhaps, than none), is that a professor who has not specially studied the subject should do this work for him, so as to carry him rapidly "through" the subject. At best the student then knows only its length, not its breadth, nor metes and bounds.

That kind of instruction is not education; it is mere stuffing; and stuffing which the next thing stuffed into the student crowds out again. It is a pity that the professorial mind does not more clearly perceive that the most lasting and most real service which it renders to the student is to train him to think and to work for himself. If this were made more of a guiding axiom we cannot but think but that less use would be made than is made of professorial abstracts of all knowledge to carry the student in a sedan chair over ground where he should be made to walk on his own legs, even if he did not walk so far.

All engineers of any standing have acquired a certain specialized knowledge of certain departments. Comparatively few of them have attempted to tell all they know on these subjects in books, but large numbers of them might be availed of with advantage to give a certain limited amount of instruction in those subjects, as we have already noted. As an illustration of a recent excellent beginning in this direction, and also as an act of justice, we may quote the following passage of a note from Prof. Geo. F. Swain, of the Massachusetss Institute of Technology:

> I noticed a short time ago in your paper mention of Mr. North's lectures before our students, in which you stated that you could not say whether he gave one or two. Perhaps it may be interesting for me to state that this year our students have had outside lectures as follows: A course by Mr. George W. Blodgett, Electrician, Boston & Albany R. R., on Railroad Signaling; two lectures by Mr. E. P. North, and two by Mr. James Owen, on Highway Engineering; two by Mr. John R. Freeman, on Fireproof Construction and the Hydraulics of Fire Protection; one by Col. Charles W. Folsom, on Sewer Construction; one by Mr. Desmond Fitz Gerald, on the Boston Water-Works; and four by Mr. Eliot Holbrook, on Railway Maintenance and the Arrangement of Yards and Stations.

The next and concluding article of this series will be devoted chiefly to actual and possible methods of instruction in fieldwork.

LETTERS TO THE EDITOR.

THE LAW OF UNEQUAL FOUNDATION LOADS.

Sir: In reading Professor Greenleaf's admirable method of illustrating the "middle third theory for foundation loads," published in Engineering News of May 11, the following was suggested to me, which may prove interesting to some:

If we should first apply the load to Professor Greenleaf's block on the edge of the middle third, we would get, as shown, an impression, a longitudinal section of which is a triangle. The area of this triangle is equal to $\frac{R}{n}$, R being the result and normal load, and n the number of units the block is wide; or, if we take a block one unit in width, the area equals R.

If the load R be now gradually moved from the first assumed point toward the nearest edge, the further edge will begin to rise, as was shown, while the other edge will sink deeper into the sand.

When the load reaches the edge of the block, a theoretical section of the resulting impression will be a rectangular hyperbola. The truth of this can be proved as follows:

Since the reaction of the sand in all cases must equal the applied load, R, and since the upward pressure varies as the ordinates to a triangle, the area of this triangle in all positions of the load is equal to R. Hence, assuming rectangular co-ordinates, and also x and y, the two sides of the pressure triangle, we will have: Area triangle $= \frac{1}{2} x y =$ a constant, R, or $x y = 2R$, which is the equation for a rectangular hyperbola.

Very truly yours,

W. Halliburton.

Phoenixville, Pa., June 5, 1893.

STRENGTH OF STEEL COLUMNS.—CORRECTION.

Sir: We note in your issue of June 1, 1893, an excerpt from the building ordinances of the city of Chicago, and would beg to call your attention to an error which appears in the formulas for calculating the strength of steel columns. The symbol "S" in the other formulas represent the total safe load for the column, and to make the formulas for the steel columns uniform with the others the symbol for area of cross-section (a) should be inserted. The two formulas for steel columns have been transposed, and should read as follows: For riveted and other steel columns, if more than 60 r in length:

$$S = a\left(17{,}000 - \frac{60\,l}{r}\right)$$ a, l and r as before.

If less than 60 r in length:

$S = 13{,}000a$, a as before.

Yours truly,

F. H. Kindl,

Structural Engineer, Carnegie Steel Co.

Pittsburg, Pa., June 5, 1893.

(The change in the symbol originally used to "S" was due to the lack of that peculiar form of symbol in our Linotype machine font. For the transposition of the formulas we find our copyist was responsible.—Ed.)

The Park Boulevard, running from the new City Hall to Fairmount Park, in Philadelphia, has been officially placed on the city plan by the Board of District Surveyors, in accordance with an ordinance passed by the City Councils on April 12, 1892. It now seems certain that Philadelphia will some time have a magnificent diagonal boulevard, and the long-prevailing rectangular street system will be broken in upon. The estimated cost of the improvement is $6,000,000, but councils have yet to raise the money and authorize the Department of Public Works to go to work. There is naturally much opposition from property owners on the line of the Boulevard.

Armor-piercing projectiles to be fired from mortars are being furnished to the government by the Wheeler-Sterling Patent Deck-Piercing Projectile Company. A test of these projectiles was made at the Sandy Hook proving grounds on June 9, for the acceptance of a lot of 245, for which the contract price is $58,500. Two shells were fired with a charge of 60 lbs. of powder, giving an initial velocity of 900 ft. per second, the projectile weighing 775 lbs., and being designed for the new 12-in. mortars. The target was an oil-tempered steel plate 4½ ins. thick, set at an angle of 60°, and backed by 3 ft. of yellow pine. The first shot pierced plate and backing, but the rear half was badly shattered. The second shot passed through plate and backing without injury.

The Lake Erie and Lake St. Clair ship canal proposes a cut 14 miles long, and the estimated cost is $3,000,000. Mr. C. C. Wyatt, the chief promoter, claims that New York and Minneapolis capitalists stand ready to build the canal; but, beyond securing a 90-day option on land which would form the St. Clair outlet, little real progress seems to have been made. As proposed, the canal would be 21 ft. deep and 150 ft. wide at surface.

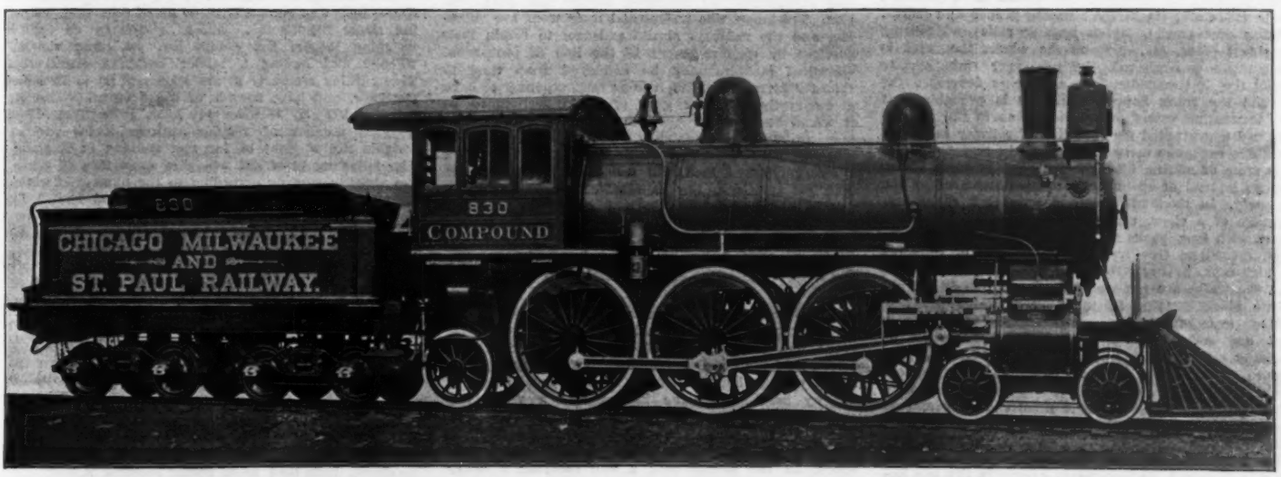
HEAVY EXPRESS COMPOUND LOCOMOTIVE; CHICAGO, MILWAUKEE & ST. PAUL RY.

There is an increasing tendency to use engines with six driving wheels for express service, owing to the weight of the trains and the comparatively frequent stops which are made by such trains on some roads. The engine illustrated herewith is one of three built by the Rhode Island Locomotive Works, Providence, R. I., for the Chicago, Milwaukee & St. Paul Ry. They are intended for the service between Chicago and Milwaukee, a distance of 85 miles. The engine forms a part of the Rhode Island Locomotive Works' exhibit at the World's Columbian Exposition, and we are indebted to the builders for photographs and particulars.

The engines are practically of the ten-wheel type, but have a rear pony truck in order to keep the wheel loads within the railway company's limits. As far as we know this is the only road which has engines of this particular type, though many roads use ordinary ten-wheel engines in heavy express service. The engines are of the two-cylinder compound system, with the form of intercepting valve illustrated in our issue of Dec. 12, 1891. They are intended to burn bituminous coal. The boiler is of 5/8-in. steel, with 1-in. rivets. All horizontal seams and the junction of waist and firebox are double riveted. Longitudinal seams have lap welt with rivets alternating on both sides of the main seams. The back head is a perfect circle. The boilers are tested to 220 lbs. per sq. in. steam pressure and 260 lbs. with warm water. They have an extended wagon-top, with extension arch, and the dome, 30 ins. diameter, is placed on the wagon-top. The ashpan is of wrought iron, with damper back and front. The main frames are of best hammered iron, forged solid. The cast iron balanced poppet throttle valve is placed in the vertical arm of the dry pipe. Feed water is supplied by two injectors.

The cylinders have double sight feed lubricators, and the slide valves are of the balanced pattern. The pistons are of cast iron, with cast iron spring packing rings, and the piston rods and guides are of hammered iron. The piston rods and valve rods have metallic packing. The cross head is of cast steel, babbitted. The valve motion is of the shifting link type. The driving wheels have cast iron centers turned to 6 ft. diameter, and steel tires 3 ins. thick. The first and third pair of driving wheels have flanged tires 5¾ ins. wide, while the second pair has plain tires 6½ ins. wide. The axles and connecting and coupling rods are of hammered iron. The rods are all fluted. The driving box linings and connecting rod bearings are of Damascus bronze. The tender has a white oak frame, and ¼-in. steel tank, carried on two center bearing trucks. The air brake is fitted to all driving and tender wheels. The general dimensions and particulars of the engines are as follows:

Running Gear.	
Driving wheels, diam.	6 ft. 6 ins.
Truck " " (leading)	2 " 9 "
" " " (trailing)	3 " 6 "
Tender " "	2 " 9 "
Engine truck, length of radius bar (trailing)	4 " 9¾ "
Engine trucks, swing or rigid center	Swing center
Journals, driving axles	8 × 8¾ ins.
" truck axles (leading)	5½ × 10 "
" " " (trailing)	6 × 10 "
" tender axles	4¼ × 8 "
Wheel Base.—Driving	13 ft. 6 ins.
Truck (leading)	6 " 0 "
Total, engine	29 " 9¼ "
" tender	15 " 0 "
" engine and tender	50 " 6¾ "
Center of leading truck pin to center of leading driver	7 " 10 "
Center of trailing truck pin to center of rear driver	6 " 11⅜ "
Driving wheels having blind tires	Middle pair
Weight in working order; on drivers	88,500 lbs.
On truck wheels (leading, 36,500; trailing, 18,000)	54,500 "
Engine, total	143,000 "
Tender, "	75,000 "
Engine and tender, loaded	218,000 "
Tender, empty	30,000 "
Of full coal capacity	13,440 "
Cylinders, h. p. (one)	21 × 26 ins.
" l. p. (one)	31 × 26 "
Distance center to center	7 ft. 1 in.
" center to valve face, h. p.	1 ft. 5½ ins.
" " " " l. p.	1 " 10½ "
Piston rod, diam.	3½ "
Form of crosshead and guides	Laird
Connecting rod, length between centers, 10 ft. 3½ ins.	
Valve Gear.—Type	Shifting link
Ports: steam, h. p., 1½ × 20 ins.; l. p., 1½ × 25 ins.	
" exhaust	3 × 20 ins.
Slide valves; lap, h. p., 1¼ ins.; l. p.	1 in.
" " max. travel	6¼ "
" " lead (full gear)	3-32 "
Boiler.—Type	Extended wagon-top
Diam. of barrel inside	5 ft. 2 ins.
Thickness of barrel plates	5/16 in.
Thickness of smokebox tube plate	½ "
Height from rail to center line	8 ft. 11 ins.
Length of smokebox	6 ft. 1 in.
Working steam pressure	200 lbs.
Firebox.—Type	Radial stay
Length inside	10 ft. 0 ins.
Width inside	2 " 9⅜ "
Depth at front	6 " 10¾ "
Depth at back	6 " 0⅝ "
Thickness of side plates	5-16 "
" back plate	⅜ "
" crown sheet	½ "
" tube sheet	½ "
Crown sheet staying, radial stays, diam.	1⅛ ins.
Grate area	28 sq. ft.
Staybolts, diam., ¾ and 1 in.; pitch	4 ins.
Water space, width sides and back, 3½ ins.; front, 3½ to 4 ins.	
Tubes.—Material: charcoal iron; number, 272; pitch, 2¾ ins.	
Diam. inside, 1¾ ins.; outside	2 ins.
Length between tube plates	12 ft. 8⅜ "
Miscellaneous.—	
Smokestack, smallest diam.	1 ft. 3 ins.
Smokestack, height from rail to top	15 " 2 "
Capacity of tank	4,000 gallons.
Capacity of coal space	13,440 lbs.
Brake fittings	American



COMPOUND LOCOMOTIVE FOR HEAVY EXPRESS SERVICE; CHICAGO, MILWAUKEE & ST. PAUL RY.

Exhibited at the World's Columbian Exposition by the Rhode Island Locomotive Works.

THE RELATIONS OF TRACK TO TRAIN SERVICE.

The following practical paper on the relations between tracks and trains, by Mr. E. E. Russell Tratman (Associate Editor of Engineering News), is reprinted from the special railway number of the New York "Independent" for June 1, which number contains several interesting papers on railway operation and on different questions of what is known as the railway problem:*

The steady growth of railway traffic and the tendency to increase in the weight and speed of trains, both in passenger and train service, make the importance of the relations between the track and the trains more and more apparent. The track is the first requirement for a train service, but when once it has been laid it is apt to be very generally considered, except by those directly connected with it, as something permanent and imperishable. The number of trains and the weight and speed of trains are increased with little regard to the capability of the track; and it is a fact too well known to need discussion here that track improvements are very much subordinated to train service, taking the railway system as a whole. It is certainly true that the increase in traffic is leading to an extensive improvement of track; but this is by no means universal, and in many cases the increased traffic has been put on and then found to damage the weak track so as to make repair or reconstruction inevitable. The tendency to liberal expenditures for heavy and elaborate cars and to parsimony and delay in track improvements was shown in a paper on "The Improvement of Railway Track," read by me before the American Society of Civil Engineers in 1889; and I believe the remarks therein made are as appropriate now as they were then.

The American traveling public has long been used to luxurious accommodation in the way of handsomely appointed and completely equipped parlor, sleeping and dining cars, and passenger departments have vied with each other in providing and advertising such accommodation. The same public is also now becoming more and more accustomed to high speeds, and the express train traffic is increasing. A "Vestibuled Limited," "Fast Mail," "Flyer," or "Day Express," is taken quite as a matter of course, and at the head of this class of train is the celebrated "Empire State Express," the fastest train and fastest long distance train in the world; but for length of run this is to be rivaled by the "Exposition Flyer," making the run between New York and Chicago in 20 hours. Besides these there are the numerous "cannon ball" and "lightning" expresses of more local fame, which may be ranked as second class but which are often heavy trains and run at high speeds, especially in making up time.

The trains of the first class may be assumed to run,

*The list of papers in the railway number of "The Independent," New York, June 1, is as follows: W. M. Acworth, London, England, "Government Interference in Railway Management"; Augustus Schoonmaker, ex-Interstate Commerce Commissioner, Kingston, N. Y., "Limitation Upon Railway Powers"; James Peabody, Editor Chicago "Railway Review," "Government Regulation of Railway Compacts"; C. C. McCain, Auditor of Interstate Commerce Commission, Washington, "Reduction in Freight Charges"; Martin S. Knapp, Interstate Commerce Commissioner, Washington, "Discrimination by Railways"; Col. A. F. Walker, Chicago (probably), "Amendment of the Interstate Commerce Law"; George G. Crocker, Boston, ex-Railroad Commissioner of Massachusetts, "Stock and Debt Watering"; Gen. Wager Swayne, New York city, "The Legal Aspect of Railway Strikes"; E. E. Russell Tratman, New York city, Associate Editor of "Engineering News," "Tracks and Train Service"; Nat. Sawyer, Engineer on N. Y. Central Railway, "Relation of the Brotherhood to the Railroad Companies."

in the main (though by no means invariably), over roads of excellent, good or fair construction, and, therefore, reasonably qualified to carry such traffic, although the track is probably not much considered in arranging the train service. The trains of the second class, however, are in many cases run over roads which are by no means suited for such traffic, having an inferior track and not being well equipped in regard to double or side track, switches, signals, crossings, etc., to provide reasonable safety for these high-speed trains. Frequent accidents, therefore, happen through inability to keep other trains out of the way of the express, either by lack of facilities or the common cause of disobedience and disregard of train orders by men who think they can reach the next passing place before the express, and are too often mistaken in their calculations. These expresses are often unpunctual through being delayed, the regular traffic not allowing of a straight, fast run; and enginemen are liable then to run at very much more than schedule speed in order to make up time, thus throwing still more strain on the track; and this unpunctuality tempts the crews of other trains to make chance runs in defiance of train orders.

In England the Board of Trade has adopted certain standards of construction, and requires all work to be in accordance with them, the standards applying equally to main lines and insignificant lines. This imposes upon the railways an enormous expense, which is very detrimental to their financial returns, and on the secondary lines is often out of all proportion to the traffic. This is done in the interests of the public, and, laying aside the question of expediency, it may be said that great care is taken to insure safety in operation. In the United States there is no such control of the railways (though a certain amount of government regulation seems certainly to be desirable for many reasons), and while some of the lines which have attained the dignity of trunk lines have improved their roads and tracks by reducing grades and curves, adding new tracks, laying heavier rails and putting in signal plant, etc., yet, on the whole, the track is comparatively neglected, the passenger train service being the first consideration, and being developed far beyond the track improvements. It is probable that the fluctuating values of railways, due to the dangerous and uncontrolled manipulation of railway securities by stock exchange methods, are largely responsible for this state of affairs, money being sunk in stock speculations instead of spent upon the improvement of the property. In England, again, fast trains have the advantage of a clear, open line, double track or sometimes with four tracks (as on a few lines in this country), fenced in, free from level crossings of railways or highways, having strong and substantial structures, and the trains are run under the protection of the absolute block system. In the United States the fast trains are often run over single track roads and are seriously hampered by the necessity of avoiding other trains (as already noted), and by having to slow up for railway crossings, trestles, old bridges, etc., while, except on a few lines, which have adopted the block system to a greater or less extent, they are run by the train-dispatcher system, which is not efficient for the safe handling of such traffic.

The track of many American trunk lines is fully as good as standard English track, except in the one important point of rail fastenings. The rails are heavy and well made, laid on an ample number of first-class ties (often with steel tieplates between rails and ties) in good ballast; but they are secured to the ties by spikes which are nothing more than large nails. The ordinary rough track spike is a disgrace to a main track; it tears and crushes the fibers of the wood so barbarously that its hold is but slight, and though improved spikes with smooth sides and clean, sharp edges and points are used to some extent, and get a better hold on the wood, yet the spike, in itself, is not a sufficient fastening for rails which are to carry heavy trains at high speed. This is the weak spot of much of our best track, for even on such tracks it is common to see loose spikes, forced outward or pulled upward by the movement of the rail. Newly driven spikes in ordinary ties have a tolerably firm hold, but it is rapidly reduced by the constant vibration and working of the rail under traffic.

Rails should be heavy and of good quality, for experience has shown that it is better economy to pay a high price for a good rail than a low price for an inferior rail which will not only make a worse track by its wear, and give less service, but will lead to all the expense and inconvenience of increased maintenance and more frequent renewals. The same applies to the track generally; for the more substantial and permanent the track, and the less it is disturbed for renewals, repairs, surfacing, etc., the better it is for the traffic, in regard to operating expenses, comfort and safety. The rail fastening should be of a type giving a positive hold on the tie, and not merely the negative hold of the large nail called a spike. The rail joint is probably a grievance on every railway. The number of devices is legion, but the joints that will efficiently support the rail ends and prevent cutting out of the rails are very few. The ties must be of good quality and dimensions; and if treated by preservative processes and protected by metal tieplates to prevent wear at the rail seats, so much the better for the traffic. Frogs and switches should be of good design and strong construction, well laid and well looked after. Switches and track crossings should be protected with interlocked distant signals, even if the block system is not in force on the open line. The unprotected switch is one of the greatest dangers to traffic. Periodically a trainman leaves a switch open after his train has run onto the side track, and the engineman of the fast train sees it too late to avert a collision. In this connection it must be considered how far it is safe to run express trains without the protection of signals or the block system.

Railway companies, including more especially the directors and the higher officers of the financial departments, very generally fail to recognize the importance of the track, and to realize the economy of proper maintenance of track and road. Not only are renewals delayed, old structures patched up and repatched, and safety equipment dispensed with, but track forces are reduced and their wages kept down. There is a strong and widespread sentiment of discontent among section men and foremen at the lack of remuneration and encouragement; and it is hard to keep a permanent gang, except on roads where a more enlightened system is in force than that of considering any tramp or laborer as good enough for trackwork. The trackmen's work is little regarded; yet if these men relaxed their vigilance or failed in their duty, not all the skill and faithfulness of the enginemen and train crews, or the elaborate equipment of the trains, could give a satisfactory train service or prevent accidents. A little inattention to a weak spot in the track, a neglected loose joint, a defective switch or frog, an overlooked broken rail, or spikes not properly redriven, and the "lightning express" goes into the ditch with more or less disastrous results, and involving more or less expenditure for damages, repairs and compensation. Trackmen who understand their work are valuable, and the railways should endeavor to retain their services by encouragement in the line of promotion. Unskilled laborers may be employed from time to time for extra work; but it is as false economy to have a constantly changing gang of green sectionmen as it would be to follow the same practice with enginemen, trainmen or machinists. These green sectionmen will use more time and material in doing bad work than experienced men will use in doing good work. And yet, perhaps, the road which is thus foolishly saving cents in trackwork, and giving its trackmen just cause for complaint, is spending dollars on elegant palace cars, increasing train speeds and advertising its fast trains and elegant equipment, ignoring the destructive effect of such service on a weak and insufficiently maintained track.

I may here note two examples which illustrate the force of the foregoing remarks. In the first case, the track was of fairly good 60-lb. rails laid on ties so rotten that the ends were almost rotted away, and the spikes were so loose that many of them could be pulled out by hand, while the ballast was a very dirty gravel, loose and uncared for. Yet heavy express trains, with ponderous engines and dining and sleeping cars, ran daily over that track at pretty good speed. In the second case a line carrying a heavy summer tourist traffic in sleeping and parlor cars had its track in condition worse than that of an ordinary country freight side track. The rails were worn to the last degree, loosely spiked to irregularly spaced ties of inferior quality, and spliced by short fishplates, with many of the splice bolts missing. An instance of a type of accident which gives a bad name to American track and railways was the derailment of the "F. F. V." express on the Chesapeake & Ohio Ry. near White Sulphur Springs, W. Va., on Dec. 28, 1889. It was a splendid and elaborately equipped train (whose attractions were widely advertised), consisting of a mail and express car, day car, dining car and two Pullman sleeping cars, hauled by a ten-wheel engine. The train was wrecked by a broken rail on a track laid with 58-lb. rails insecurely spiked to ties of poor quality. New 70-lb. rails were gradually replacing the lighter ones. Ten persons were killed and 13 injured. At the present time I know of a road running regular fast trains of eight cars (sleeping, dining and mail cars), weighing, with engine and tender, about 425 tons, over track laid with 60-lb. rails. It is true that the track is being gradually relaid with 70-lb. rails, but meanwhile this heavy traffic is running, and has been running, over the light track.

But the track is only one side of the question. Now let us look on the other side, namely, that which relates to the trains. In this country there is no such large proportion of light fast trains as in England, and the express trains are very generally heavy and composed of heavy cars, especially the long-distance trains. In the proportion of dead load to live load—that is to say, in the proportion of the number and weight of passengers (the paying or live load) to the weight of the empty train (or dead load) which has to be hauled at the company's expense—we find the two extremes in England and the United States. In this country the extreme of dead load is reached and often carried to excess, in "palace" cars especially, in order to secure comfort, steadiness and noiselessness, while in England the extreme of live load, or carrying capacity, is reached, and often carried to excess at the expense of the comfort of the passengers, making a crowded, noisy and rough-riding car. American sleeping cars are about 70 ft. long, accommodate 26 to 30 persons, and weigh about 85,000 to 100,000 lbs., while dining cars weigh about 80,000 lbs.

The fastest trains on the Great Northern Railway, of England, between Manchester and London, 203 miles, consist of five six-wheel cars and weigh about 168,000 lbs.; they are drawn partly by engines weighing 103,040 lbs., with 71,792 lbs. on four large driving wheels. The London & Northwestern Ry. runs between the same places (183½ miles) trains of 10 cars, weighing 291,200 lbs., with an engine of about 88,000 lbs., with 73,000 lbs. on four driving wheels. The Lancashire & Yorkshire Ry. has a number of fast trains on 50-mile runs, made up of ten cars, and weighing about 325,000 lbs., hauled by engines of 98,560 lbs., with 69,440 lbs. on four driving wheels. The heaviest expresses on the Great Northern Ry. average 16 cars, or 537,000 lbs. in summer, and 12 cars, or 403,200 lbs. in winter. These are hauled by engines of 101,136 lbs., with 38,080 lbs. on a single pair of 8-ft. driving wheels, and having a tender weighing 74,704 lbs. One of the heaviest English express trains, weighing 500,736 lbs., attained a speed equivalent to 86 miles per hour; it was drawn by an engine of 104,552 lbs., with 39,760 lbs. on a single pair of driving wheels, and having a tender of 89,712 lbs.

Two of the best examples of light high-speed American trains are the Empire State Express, between New York and Buffalo, 440 miles, and the Blue Line Express, between New York and Washington, 230 miles. The first has four cars weighing 362,000 lbs., and is hauled by an engine weighing 124,000 lbs. (84,000 lbs. on the driving wheels), and having a tender weighing 80,000 lbs. The second is made up of four cars, weighing about 204,000 lbs., and is hauled by an engine weighing 123,800 lbs. (88,400 lbs. on four driving wheels) and having a tender weighing 82,000 lbs. These trains regularly attain speeds of 60 to 75 miles per hour, and have records of about 90 miles, run at rates of 102 and 97 miles per hour, respectively. But a large number of regular express trains are of weights not thought of for fast running in England. The following brief list will give some idea of these, the weights varying according to the number of heavy sleeping cars or lighter day cars; all are hauled by engines of 176,000 to 200,000 lbs. (including tenders), with four driving wheels, and make speeds of 45 to 60 miles per hour (train No. 1 even 73 miles per hour) in regular service:

Railway.	No. of cars.	Weight of cars, lbs.	Weight eng. and tend., lbs.	Weight of train, lbs.
1. N. Y. Cent'l..	12	950,800	200,000	1,150,800
2. " " ..	8	749,000	200,000	1,150,000
3. Penns'lv'nia..	9	640,606	176,000	816,606
4. " ..	11	864,500	171,650	1,036,150
5. " ..	12	618,260	176,000	794,260

I have preferred to take actual examples rather than average train loads, as averages are apt to be very misleading while engines hauling the average train load must, in this country, be capable of hauling the maximum train-load when traffic requires it.

The weight of cars of fast trains has an effect upon the track, yet heavy sleeping cars are run over all sorts of roads, and are, no doubt, responsible for many of the accidents by derailment. Such cars, too, are expensive to haul, and are very heavy in proportion to the number of passengers. That the Empire State Express has proved a remunerative train is probably due to a considerable extent to the fact that it is composed of day cars. For the same reason the New York, Lake Erie & Western R. R., in providing for the excursion traffic to the World's Columbian Exposition will pay special attention to places within about 400 miles of Chicago, so that the traffic can be handled by trains of day cars, which carry more passengers and weigh less than trains of sleeping cars. On some trains parlor cars are attached, which usually have but few passengers, and by the use of handsome, clean and well-appointed day cars, with lavatory and other accommodations (as already in service on some roads), the heavy, expensive parlor or drawing room car may be dispensed with without detriment to the train service and with economy in operating expenses. The profusion of mirrors, carving and ornament (often inartistic and unpleasing) in many palace cars involves unnecessary and unreasonable expense. Handsome and attractive cars of lighter weight, equally comfortable and more serviceable, can be built at much less cost than such palace cars, and effect economy in another item of operating expenses.

Freight traffic is also becoming more severe upon weak tracks, as car-loads, train-loads and speed are increasing. In fact, the introduction of air brakes and automatic couplers on freight cars (particularly those for coal, fruit, stock, and other special classes of freight) enables the trains to be run at speeds as high as those of passenger trains. The standard freight trains for mogul engines on the New York Central R. R. consist of 55 loaded cars, and freight train loads

of 25 to 35 cars of 40,000 to 60,000 lbs. carrying capacity are very general on all important lines, and on roads with tracks of very inferior quality.

In conclusion, it may be said that, taking the railways as a whole, and allowing for the excellent condition of a small number of the most important lines, there is a dangerous discrepancy between track and train loads, and that there should be a wider recognition of the relations they bear to each other.

THE 54-IN. STEEL SUBMERGED PIPE FOR THE SYRACUSE WATER-WORKS.*

By William R. Hill, Chief Engineer.

Introduction.—In the year of 1889, the Syracuse Water Commission, after a thorough investigation of the various proposed sources, recommended Skaneateles Lake as the best water supply available. This lake is located about 20 miles southwesterly from Syracuse, is about 16 miles long by about ¾ mile wide, having an area of 12.75 square miles, and a tributary watershed, exclusive of the lake, of 60.28 square miles.

In elevation, the high water line is 867.1 ft. above mean low tide at Albany, N. Y.; 468.4 ft. above the level of Syracuse, and 246.4 ft. above the flow line of the distributing reservoir now being constructed.

The water is taken from the northerly end of the

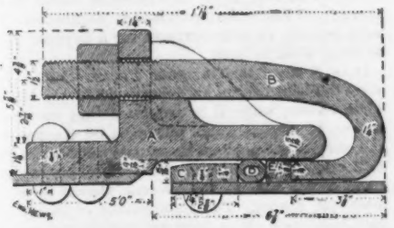


Fig. 1. Hook Bolt Joint on 54-in. Steel Intake; Syracuse, N. Y.

(A, Cast iron bell; B, steel hook bolt; C, steel spigot; D, soft lead pipe; E, wrought iron loop.)

lake by means of a 54-in. steel pipe, extending from the intake crib to the gatehouse, from which the water is carried by gravity, through a 30-in. cast iron pipe to the distributing reservoir in the city of Syracuse.

The Location.—After a strong southerly wind the water in the northerly end of the lake, where it is less than 20 ft. in depth, is rolled for a distance of about 4,000 ft. back from the foot of the lake. Taking this fact into consideration, it was necessary to reach the clear water beyond in as direct a line as possible.

In order to determine upon the location of the submerged pipe line a hydrographical survey was made, extending from the foot of the lake southerly, for about 1½ miles. The location of the lake shore and of the base line on the west side, together with taking about 3,000 soundings, were included in this survey.

In making the surroundings a small steam yacht containing the sounding party of four men was used. The soundings were taken on parallel lines, extending across the lake, from successive 100-ft. stations of the base line. Before taking a line of soundings, a transitman would set his instrument over the proper station of the base line and give line for anchoring, in range on the line of sounding, two buoys which served as guides for keeping the boat on line.

Beginning at the east shore of the lake and opposite the station of the base line, over which the transit was set, the boat was started on line and soundings taken about 100 ft. apart. As each sounding was made, the whistle was blown and the transitman at the station on base line took an angle on the whistle, as did also a second transitman, who was permanently located at the foot of the lake and in such position that the line of sight of his instrument would intersect the line on which the soundings were taken, at nearly right angles.

The soundings were measured by means of a steel tape, to which was attached a sounding iron, weighing about 4 lbs. The sounding iron had a concave base, which was filled with soap, thus affording a means of obtaining a sample of the material forming the lake bottom. As soon as a sounding was made, the recorder, on board the boat, entered in his book the number, the depth and the time. The two transitmen on the shore also recorded the number of the sounding, the angle and the time. From these notes the 3,000 soundings were easily plotted, and an accurate contour map of the lake bottom was made, from which the final location of the pipe line was determined.

The intake crib was finally located in 38 ft. of water, 6,410 ft. from the gatehouse on the shore, at the north end of the lake.

Three separate analyses of water taken at the surface directly over the crib, halfway down and at the crib respectively, show the water at the crib to be the purest, the surface water next, while the sample taken halfway down ranked third in quality.

The Construction.—This work consisted of about 6,400 ft. of single riveted steel pipe, having an internal diameter of 54 in. This pipe was made by the Groton Bridge & Manufacturing Co., of Groton, N. Y., from ⅝-in. steel plates, weighing 15 lbs. per sq. ft., rolled at the mills of Carnegie, Phipps & Co., at Homestead, Pa.

The plates were each 6 ft. wide and of such length as would form the proper circle of the pipe and the necessary lap of 2½ ins. Five of these 6-ft. sections were then telescope joined and riveted to form a rigid section 29 ft. 2 ins. in length. The edges of the longitudinal seams and of the circular joints, both outside and inside, were beveled and hammer calked until they were made water-tight without plugging or packing, the same as is usually done on first-class boiler work.

These 29-ft. sections, after being tested and coated with asphalt, were shipped to the delivery grounds on the shore of Skaneateles, where four of these sections were joined and riveted together, forming a rigid section about 116 ft. in length. On one end of this long section a spigot of 2⅝ × ⅝-in. steel was riveted, while on the opposite end there was a cast iron bell. On the spigot there was a 1 × ⅞-in. wrought iron hoop loosely encircling the pipe, and between this hoop and the steel spigot was placed a soft lead pipe, all as shown in detail in Fig. 1.

The cast iron bell was provided with 20 steel hook bolts with hexagonal nuts. After entering the spigot into the bell the hook bolts were brought to bear against the wrought iron hoop, which in turn pressed against the soft lead pipe, causing it to upset and form a cold lead joint.

There were used on this line seven universal flexible joints, shown by Fig. 2, made from steel plates, channels and angles, on the ball and socket principle, consisting of a turned cast iron hollow zone or ball, working in a spherical lead-lined steel socket and capable of a deflection of 12°, in any direction, from the axis of the pipe.

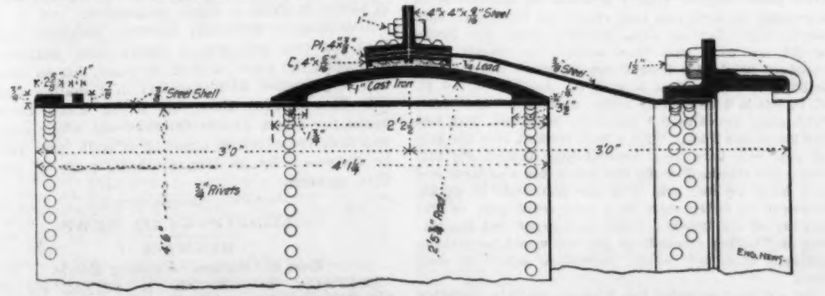


FIG. 2. UNIVERSAL FLEXIBLE JOINT ON 54-IN. STEEL INTAKE; SYRACUSE, N. Y.

The plates were of mild steel and of an ultimate tensile strength of from 55,000 to 65,000 lbs. per sq. in.

All plates were required to be able to stand the test of punching a row of holes ¾ in. in diameter, pitched 1¼ ins. between centers, without causing cracks; and also to withstand the test of enlarging to the extent of one-third their original diameters, a row of punched rivet holes, center pitched two diameters from the edge of the plate and three diameters apart, without cracking the sheets.

Strips cut from the sheets lengthwise and crosswise were required to stand the test of cold-bending double, flat under the hammer, without fracture. The plates had to be tough and pliable enough to allow of cold scarfing to a fine edge, at the laps, without cracking, and to be rolled to the circle of the pipe, without cracking between the rivet holes and the edge of the plate.

The plates were shipped from the rolling mills to Groton on flat cars provided with roofs to protect the steel from rain. After being unloaded the plates were laid out and hand pricked for punching from carefully made templets; they were then passed to the punch and then to the chamfering machine, where both the side edges of each plate were cut to curves, so that in bending the plate to the circle of the pipe, the ends of the 6-ft. telescope section thus formed would be at right angles to the axis of the pipe and have an internal diameter of 54 and 54⅝ ins., respectively. The edges of the plates at the lap were next beveled to a fine edge by hammering, and were then passed to the rolls, which were so arranged that the plate was formed to the proper circle. As soon as they were thus formed, they were temporarily held in shape by bolts and were then assembled for riveting.

In this portion of the shop there were two parallel handcar tracks, just far enough apart to allow men to work handily between the two cars, on which the pipe sections were placed. Over these tracks was suspended an Allen pneumatic riveter. As soon as the rivets were driven on the pipe section on track No. 1, the riveter was swung over track No. 2, where in the meantime another section had been put in position by the assemblers. Then, while the riveter was working over track No. 2, the assemblers placed another section in position on track No. 1. This rotation was kept up until five 6-ft. sections had been riveted together, making a 29-ft. section. These long sections were then placed on skids in another part of the shops, where the seams were calked with a pneumatic tool and the pipes thoroughly cleaned from all scales or dirt. They were then inspected and taken to the dipping tank to receive the asphalt coating.

The dipping tank was made of ¼-in. steel plates, and was 31 ft. long by 5½ ft. wide by 5½ ft. deep, having the bottom rounded and fitted with rolls to allow the pipe to be revolved in the bath. Extending underneath and supporting this tank was a brick furnace fitted with an ordinary grate for burning wood.

The coating was a mixture of the Los Angeles Oil Burning Supply Co.'s dry asphalt, grade D, and their liquid asphalt, grade G. To start a dip, it was necessary to use three parts of D to one part of G; but once started, it was necessary to add the grade G only.

The temperature of the mixture was tested by immersing in the boiling mass a piece of ⅝-in. steel plate about 6 ins. square, which was allowed to remain therein about 10 minutes, when it was removed and immediately cooled in ice cold water. If the coating did not crack or fly off upon striking the plate with a hammer and did not soften at a temperature of 100° F., it was considered to be of the proper temper. The pipe was then completely submerged in the bath, and left therein at least 20 minutes, or long enough for the steel to attain the temperature, not less than 280° F., of the mixture. It was then withdrawn, and the coating allowed to stiffen for a few moments, and then again immersed a short time to thicken the coat.

The pipes were raised and lowered into the bath by means of a derrick. It required about 45 minutes to properly coat one of the 29-ft. sections.

The Laying.—The contract for laying the submerged pipe was awarded to Messrs. Hingston & Chapman, of Buffalo, N. Y. Before laying any pipe they constructed a catamaran 95 ft. long, 30 ft. wide and 6 ft. deep. This was made in two sections, each 96 ft. long and 12 ft. wide. The sides and ends of each section were formed entirely of 6 × 12-in. oak timbers, placed on top of each other and secured by bolts. These two sections were placed side by side and 6 ft. apart, and held in this position by five 12 × 14-in. oak timbers. Each section was covered by a plank floor, but the 6-ft. space between the two sections was left open.

Over this opening were arranged three timber supports for the pulley blocks, from which a length of pipe could be suspended.

The intake crib, 16 ft. square and 12 ft. deep, was constructed of 10 × 12-in. oak timbers, dovetailed and secured by 1¼-in. rods. This crib, containing a short bell-mouth section of the intake pipe, having a flexible joint attached to its outer end, was built on board the catamaran, and after being carried out near where it was to be anchored it was launched and floated in position between four guide piles. Stone ballast was then added until the crib sank upon the broken stone foundation, which had already been prepared. After the crib had been placed a section of the steel pipe, the ends of which had been closed by oiled canvas, was rolled off the skids into the water and floated out to the catamaran, which was held in position by spud piles over where the pipe was to be lowered. The pipe was then drawn into the open space between the two sections of the catamaran, where the timber saddle pieces were fastened to the pipe and the rope and tackling adjusted.

Upon removing the oiled canvas bulkheads, the pipe filled with water, and, supported by ropes, it was lowered into position on the lake bottom. Before the ropes were removed the divers entered the spigot into the bell, adjusted the hook-bolts, and by screwing up the nuts, upset the lead pipe and formed the joint.

The booms from which the pipe was suspended were

*Slightly condensed from a paper read before the New England Water-Works Association at its annual convention at Worcester, Mass., June 14 to 16.

so constructed that the pipe could also be moved longitudinally. As the catamaran was made so large and of such heavy timbers, there was no trouble experienced from unsteadiness, except when the water was very rough; however, under ordinary conditions, the contractors were able to lay one of the 116-ft. sections in one day.

The total cost of the steel pipe, including the flexible joints, delivered on the skids at Skaneateles Lake, was $8.80 per lin. ft., and the contract price for laying the same was $2.50 per lin. ft.

Owing to the trench not being dredged, the pipe laying was suspended last fall, and there still remains about 2,000 ft. of pipe to be laid in the lake.

This dredging is now nearly finished, and the pipe laying will be resumed about the first of July.

All of the 30-in. cast iron pipe for the conduit line from the lake to Syracuse will be delivered by Aug. 15, and pipe laying is now in progress on all four sections of this line. The work on the new distributing reservoir is also well under way, but will not be completed until the fall of 1894.

It is expected, however, to have Skaneateles Lake water into the present reservoir before the end of the current year.

I wish to state that much credit is due to Mr. Howard Soule, Consulting Engineer of the Syracuse waterworks, for the preparation of the specifications and for the design of the joint used on this pipe.

THE WESTERN RAILWAY CLUB'S TESTS OF M. C. B. COUPLERS.

A series of exhaustive tests of M. C. B. couplers of different makes has just been concluded by a committee of the Western Railway Club. Each coupler was carefully measured and weighed, and tested with the M. C. B. standard gages. Out of 31 couplers 12 were so much out in contour that the gages would not go on, and only two are reported "correct" by the committee. In the drop tests a large number of couplers failed in the shank, but the results were on the whole very good. The results in the pulling tests are given below. The following is the matter of principal interest in the report made by the committee in presenting the results of the tests:

The drop tests were made from a height of 10 ft 4 ins. and 15 ft. 4 ins., the foundation, which was of masonry, sinking during the tests about 4 ins. The drop tests as conducted were criticised by some of those present, and apparently with reason, as not in all cases representing the same blow, owing to the bar flying away from its position after being struck. This may be a legitimate criticism; if there is any point in it the fault will be checked up by the M. C. B. tests, which have since then taken place at Altoona, the M. C. B. committee having arranged to wedge in their bars so that they could not fly off while under test. The committee's object in not securing the bar was in order to introduce a guard arm test; this, however, did not turn out as was expected, and in future investigations this feature should be worked out more carefully and properly provided for.

In the pulling tests all but two of the 13 bars met the test. Of those failing the Janney gave way at the tail end of the knuckle and the Williams at the lugs of the drawbar. The 120,000-lb. pull was met by six of the remaining 11 bars. An attempt was then made to pull the six intact bars to destruction. The Drexel reached 132,800 lbs., when part of the testing apparatus failed, viz., the head pulled off the iron tail bolt, which was 2 ins. in diameter. The other bolts not fitting, the test with this particular bar was abandoned, and one of the Chicago bars substituted. At 142,000 lbs. it was observed that another part of the testing apparatus was giving way; the yoke fastening commenced to spread and the yoke bolt bent. It was therefore decided to abandon all further attempts at pulling bars to destruction.

It has been previously stated that the tests were exceedingly instructive. Let us briefly consider some of the special features developed.

1. It was proved beyond all peradventure that in so far as the present M. C. B. tests are concerned drawbars can be made of either malleable iron or steel, not only to meet the tests but to go much beyond them.

2. The committee was made to realise fully that its investigations were not nearly as thorough and searching as they can be made, and that these tests must only be regarded as the commencement of shop investigations.

3. Great carelessness on the part of the manufacturers in the matter of conforming to the M. C. B. contour lines was shown to exist.

It certainly must be regarded as exceedingly satisfactory to know that bars can be made of the M. C. B. type of either malleable iron or cast steel not only to meet the present M. C. B. requirements, but to go as much beyond them as may be reasonably desired. Cast steel has always held a higher market value than malleable iron. The M. C. B. rules allow cast steel to be charged at 7 cts. per lb., and malleable iron at 4 cts., and it is probable that these figures may be lowered at the coming convention. The great demand for automatic bars in the next few years will make the item of cost a very important one to railways, and it will receive more than ordinary attention. A necessary requisite with the engineer in mechanics is his knowledge or skill in determining the quantity and disposition of material that is required in structures to meet the services demanded. The engineer who makes a device stronger than necessary may be more politic but is not any more skilled than the one who makes them too weak. Those who have the coupler problem to solve will have to steer through the channel of these two extremes.

It is a matter of regret that the proposed guard arm test was not fully realized. It is estimated that 50% of the M. C. B. drawbar breakages are in the guard arm and perhaps 25% of the remainder are back of the head or in the shank. (The Janney coupler statistics published last week show nearly 80% arm breakages, and only 6.3% of "barrel" breakages.—Ed.) To partly remedy these points the M. C. B. committee last year advised the consideration of increasing the size of the neck immediately back of the head from 5 ins. to 5½ ins. The Chicago Coupler Co. was the only company acting on this suggestion; they sent two bars with 5½-in. necks, but owing to press of time and some confusion in the heat numbers these special bars were not tested either under the drop or in the pulling machine. An examination showed clearly the weakening effect on the shank of core holes, slots for continous attachments, and barrel openings for that worst of all fasteners the tail bolt. Drawbars can be materially strengthened and simplified if constructed for a yoke or strap fastening only, and we strongly advise both railway companies and coupler manufacturers to take this into consideration at once.

It will be observed that in each series of tests two distinct parts were tested at the same time, viz., the drawbar and knuckle. The combination test under the drop has generally worked out satisfactorily, but it is not the case in the pulling test. It would certainly seem desirable to test the pulling strength of the drawbar, especially the lugs of the bar, without knuckle in position. This test it is understood has been provided for at the Watertown M. C. B. tests.

The single knuckle lug test is another important matter that the committee could not carry out, but it should be considered in future work, as it is believed that many of the knuckle lug failures in service are due to the buffing or pulling of bars when only single lugs are in contact. A question which many would like solved is, What variations in height from center of drawbar to top of rail can we safely allow in the interchange of freight cars? The answer to this, in so far as it applies to cars fitted with the vertical plane coupler, largely depends on whether it is necessary to have two lugs always in contact or only single lugs. Let us first consider what the limits would be with two lugs always in contact. The standard height for freight car drawbars when empty is 33 ins. The vertical face of the knuckle of the M. C. B. bar is 9 ins. with a 2½-in. opening between lugs. With some knuckles the upper lug is 3¾ ins. long and the lower one 3 ins. With a 9-in. vertical face the grip of any two bars may consequently extend 4½ ins. above the standard or 4½ ins. below the standard, and still have 4½ ins. grip with the standard. It would, however, in either case be a very weak grip, as but one lug of the knuckle would be engaged and the pulling and buffing strength of the bar would be entirely different from any results heretofore shown in shop tests.

Let us next consider the greatest possible variation that can be allowed and at the same time insure the gripping together of the two lugs of each bar. The least grip to be effectual on the second lug we will assume to be ½ in. This allows a variation of not more than 2½ ins. between the center lines of any two M. C. B. couplers, viz., 34¼ ins. maximum and 31¾ ins. minimum. This, it is hardly necessary to say, would involve a degree of perfection that does not exist at the present time. Clearly, then, in service bars are constantly buffed and pulled together with only one lug in contact, and it would seem equally if not more important to adopt standards of efficiency for parts of the drawbar that develop the greatest weakness in service rather than for the bar as a whole.

One actual case of freight cars fitted with vertical plane couplers which came apart without the knuckles unlocking and which consequently had to be coupled up with link and pin, which has come to the observation of your committee, showed the bar in one car to measure 30 ins. from the top of the rail and in the other 35 ins. proving beyond question that a 5-in. variation is not safe.

The complete disregard of any attempt on the part of the majority of the manufacturers to conform to the M. C. B. contour lines as called for by the Association's maximum and minimum gages should call for some vigorous action on the part of the members of the Association. That vertical bars should be sent for test that will not couple with each other seems an astonishing fact, but it is none the less true, and may be expected to continue just so long as railroad companies are indifferent and careless about the matter. Each railway company should have at its own storehouse a set of the Pratt & Whitney standard gages and check up with them all vertical plane drawbars purchased. Bars which are sent on the road that will not couple together are a source of danger and undo the very object automatic bars strive to remedy. There is no safety accomplished in having to couple together two vertical plane couplers with a link and pin.—G. W. Rhodes, C. H. Quereau, T. C. McWynn, F. W. Sargent, D. L. Barnes, C. H. Street, committee.

THE TROLLEY ON THE ERIE CANAL.

Within the next few weeks some experiments will be made by Mr. Hannan, State Superintendent of Public Works, with the view of testing the feasibility of operating the Erie Canal by electricity, in accordance with the recommendation of Governor Flower. The trolley system is to be tried and $10,000 are available for the experiment. According to investigations made $1,000,000 would equip the canal and provide for 12 power-houses 30 miles apart. There is abundant water power along the route for generating electricity. The total expense to each boatman for a dynamo would be from $150 to $200.

It is claimed by Governor Flower that it now costs the boatmen on an average $2.00 per day for horse power; while it is estimated that the trolley system of towage would only cost 60 cts. per day, and that this would make so much difference that at 2 cts. per bushel for grain carried the boatmen could make money; the present charge is 4⅜ to 5 cts. per bushel. The maintenance of the towing-path now costs about $400,000 per annum, and this sum would be saved if the trolley were adopted.

The members of the Union for the Improvement of Canals are not enthusiastic over Governor Flower's plan. They say it will cost much more than $1,000,000 to equip the canal, and that the figured cost of 60 cts. per day to the boatmen is much too low. Others say that the true solution of the problem is to deepen the canal to 9 ft. and then use a steam towage system, with an increased speed per hour of from five to six miles. The trolley presupposes a screw propellor on the boat operated by transmitted power; and many believe that the present section of the canal does not furnish water enough for this use of the screw. The overhead cable system is more favored by some, as providing a dead pull, without the slip and waste of power incident to screw propulsion.

Mr. Horatio Seymour, ex-State Engineer, says that the true solution of better canal service is to deepen the canal to 9 ft. at least, for no vessel can be propelled with economy in a shallow channel. He believes that this depth could be secured for about $1,000,000 over the whole canal, and that the carrying capacity of each boat would be increased by 50 tons by 1 ft. more of draft thus secured.

CONSTRUCTION NEWS.

RAILWAYS.

East of Chicago.—Existing Roads.

BUFFALO, ROCHESTER & PITTSBURG.—The Clearfield & Mahoning branch of this road in Pennsylvania was opened to the public June 5. It extends from Clearfield to Dubois, a distance of 25 miles, through extensive coal fields.

LONG ISLAND.—Work is reported as progressing rapidly on the extension of this road from Garden City through Hempstead to Valley Stream.

OHIO SOUTHERN.—It is reported that work on the line between Springfield, O., and Lima, referred to last week, is being carried on day and night. The night work is conducted by electric light, the plant being set up in advance of the construction parties. Surveys are being made for continuation of the road from Lima to Toledo.

PENNSYLVANIA.—Work on the Roslyn branch of this road is being pushed by Jutte & Foley, Pittsburg, the contractors, and the tracklaying will be commenced within a month.

TOLEDO, ANN ARBOR & NORTH MICHIGAN.—This road is to be graveled and the grades improved. About 40 miles will be relaid with 70-lb. steel rails.

UNADILLA VALLEY.—Press reports say that 150 men have begun the construction of this road between Leonardsville and New Berlin, N. Y.

Projects and Surveys.

BENTON HARBOR & SOUTHEASTERN.—Incorporated in Indiana to build a road from Nappanee to the Michigan state line; capital stock, $30,000; M. Mercer, H. V. Mercer, A. S. Zook, B. G. Crary and W. V. Messick are the directors. It is stated that construction will begin this month.

INDIANAPOLIS, BLOOMINGTON & BEDFORD.—This company was recently incorporated to build a line between Indianapolis and Bedford, Ind., a distance of 80 miles, and estimates are now being prepared. It is expected to cost about $12,000 a mile. Monroe county has voted a subsidy of $72,000, and other counties will

soon hold elections. The surveys were made by Benj. Thompson, Gen. Man. Bloomington.

INDIANAPOLIS & NORTHEAST.—The projectors of this road are reported as claiming that the line will be built this year.

PHILADELPHIA, HONESDALE & ALBANY.—The New York State Railroad Commission has granted a hearing to the projectors of this road and adjourned until a survey of the route can be filed. As stated before, the road will extend from White Haven, Pa., to Albany, N. Y., 225 miles, passing through the towns of Gouldsboro, Pa.; Lake Erie, Pa.; Honesdale, Pa.; Hancock, N. Y.; and East Branch, N. Y. The road will parallel the proposed route of the Lackawanna, Catskill Mountains & Boston for 50 miles in the Schoharie Valley, between Grand Gorge and Central Bridge, and its object is to carry Pennsylvania coal to the eastern market. The contract for the construction will be awarded to the Tennis Construction Co., Philadelphia, recently chartered to build the line.

TIVOLI HOLLOW.—Incorporated to build a 1½-mile road from the New York Central tracks, near Albany, N. Y. The directors include W. B. and Howard Van Rensselaer, F. A. Harrington and M. I. Hun, of Albany.

Southern.—Existing Roads.

WAY CROSS AIR LINE.—It is reported that the extension of this road from Abbeyville, Ga., will be commenced at an early date, and that it will be built to Fort Valley, Ga., within two years. The extension to St. Mary's, Ga., is a possibility. Gen. Man., Capt. L. Johnson, Way Cross, Ga.

Projects and Surveys.

AUGUSTA & CHATTANOOGA.—It is reported that this long projected road from Augusta, Ga., to Chattanooga, Tenn., will be built by English capitalists, represented by B. F. Ferguson, Waynesville, N. C.

CHATTANOOGA WESTERN.—This line has been surveyed between Chattanooga, Tenn., and Bridgeport, Ala., 60 miles. The headquarters are at Chattanooga.

Northwest.—Existing Roads.

CANADIAN PACIFIC.—A report from Estevan, Assiniboia, states that work is progressing rapidly on the line to connect with the Minneapolis, St. Paul & Sault Ste. Marie at the U. S. boundary. The rails and ties have arrived, and tracklaying will be commenced soon. This road will also be extended, according to reports, from Selkirk, Man., northwesterly into the Dauphin country. The line would run along the northeast shore of Shoal Lake and cross over into the Dauphin country at the narrows of Lake Manitoba. A branch would thence be constructed to Gimli, thus opening up the country along the west shore of Lake Winnipeg. It is also reported that a line is contemplated through Riverside and Whitewater in southern Manitoba.

CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA.—Grade stakes have been set one-third of the distance between Ponca, Neb., and Newcastle, Neb., and it is reported that work will commence soon on the grading.

CHIPPEWA RIVER & MENOMINEE.—The petition to bond Sawyer Co., Wis., to extend this road to Hayward is reported to have been signed by nearly all of the resident taxpayers, and it is expected that the right of way will be secured soon.

DULUTH, MESABI & NORTHERN.—As stated last week, St. Louis Co., Minn., has voted $250,000 in aid of proposed extensions of this road. The plan of the company includes a line to Ely, in the heart of the Vermillion range, thence to Gunflint, where it will connect with the Port Arthur, Duluth & Western Ry. A line to Winnipeg, Man., is also included, as well as one down the Red River Valley of North Dakota to Grand Forks.

ST. PAUL & DULUTH.—This road is to be extended to Willmar, Minn., this summer, and a direct line will be run from there to Omaha, according to reports.

WINONA, OSAGE & SOUTHWESTERN.—Mason City, Ia., has voted $38,000 to this road in consideration of the extension from Osage to that place by July 1, 1894.

Projects and Surveys.

BAYFIELD HARBOR & GREAT WESTERN.—The first contract for clearing the right of way for this road from Bayfield to Iron River, Wis., a distance of 40 miles, has been awarded to John Lambert. W. F. Dalrymple, of Bayfield, Wis., Pres., and E. C. Hollidge, Engr.

MINNEAPOLIS, ST. PAUL & LAKE SUPERIOR.—F. H. Anson, of Minneapolis, general manager, is reported as saying that the contract has been let for building this road, which is projected to run from Minneapolis, Minn., through St. Paul, White Bear and Amador, Minn., and Yellow Bear, Wis., to Superior, Wis., a distance of 135.8 miles. The road will cross the St. Croix River at Amador, 40.3 miles from Minneapolis. The maximum grade is 26.2 ft. per mile, maximum curvature 3°. The line will be laid with 70-lb. steel rails and there will be three steel bridges, aggregating 800 ft. in length. The officers of the road were published in our issue of May 25.

ROCHESTER & WILLMAR.—Surveys have been completed for a road between Rochester and Willmar, Minn., a distance of 168 miles. The line is proposed to secure a direct road to Chicago from points in Southern Minnesota. Donald Grant, of Fairbault, president of the recently incorporated Minneapolis, St. Paul & Lake Superior, is president of the company. The capital stock is $2,000,000.

WISCONSIN.—Holmes & Son will build a logging road from Pembine, Wis., northwest into their pine timber lands, about 15 miles, this summer. Surveys are being made under the direction of E. L. Shaw, Cy. Engr., Marinette, Wis.

Southwest.—Existing Roads.

CHICAGO, ROCK ISLAND & PACIFIC.—Surveyors ar locating an extension between Fort Worth and Dallas, Tex., and the road, according to reports, will be pushed to speedy completion.

KANSAS, FORT SMITH & SOUTHERN.—Supplies are being collected at Siloam Springs, Ark., where work will soon be commenced on an extension of this road. It is understood that the line will run from Sulphur Springs, Ark., through Siloam Springs, Ark., to Fort Smith, and thence down the line of Arkansas and the Indian Territory, intersecting the valley route just above the Fort Smith bridge on the west side of the Arkansas River.

ST. LOUIS MERCHANTS' TERMINAL BELT LINE.—The contract for the construction of this road has been awarded to the J. Ware Construction Co. The work will be commenced at once. The road is to extend from the Merchants' Terminal line in the north end of St. Louis, passing beyond city limits and skirting the country seat at Clayton west of Forest Park and encircling the suburban tracts to Lindenwood on the St. Louis & San Francisco line. The belt will ultimately be extended to the river front at Carondelet in the south end of St. Louis.

TECHE R. R. & SUGAR CO.—We are informed by S. A. Knapp, Lake Charles, La., president of this company, that contracts for building this road between Arnaudville, Breaux Bridge, Huron Plantation and Carencro, where it will connect with the Southern Pacific, a distance of 20 miles, have been awarded, and that tracklaying is expected to begin by August. The route is through a level prairie country and with but one bridge. Romaine France, Carencro, is Chief Engineer.

TEXAS CITY TERMINAL.—Tracklaying has been commenced on this road, which is being built by Meyer Bros., Duluth, from the Galveston, Houston & Henderson, 11 miles from Houston, to Galveston Bay, a distance of seven miles.

Projects and Surveys.

DALLAS & OAK CLIFF.—The name of this company has been changed to the Dallas & Fort Worth Rapid Transit Terminal Co., and the capital stock increased to $2,000,000. The road is reported as to be built at an early date. Pres., Spencer M. Janney, of Philadelphia.

GAINESVILLE, McALESTER & ST. LOUIS.—The surveyors of this line have reached Dexter, 24 miles east of Gainesville, Tex., and are expected to cross into Indian Territory this week.

ST. LOUIS, COLLINSVILLE & EASTERN.—Edward T. Lurton, Ch. Engr., is making final surveys for this line from Collinsville, Ill., where there are large coalfields, to East St. Louis, with a branch to Madison. The line will enter St. Louis over the Merchant's Terminal's bridge. Bids are now being received for the construction of the road, and it is hoped to have the line in operation by November. J. Z. Gordon is president of the road, and the principal office is at Collinsville, Ill.

ST. LOUIS, GUTHRIE & WESTERN.—Organized at Guthrie, Okla., to build a road to St. Louis. Pres., A. E. Smith, St. Louis; Vice-Pres., Geo. Gargenheire, Stillwater; Secy., J. E. Ellis, Guthrie; Treas., J. M. McNell, Guthrie.

Rocky Mt. and Pacific.—Existing Roads.

BURLINGTON & MISSOURI.—According to press reports, this road will soon be extended from Sheridan, Wyo., to Great Falls, Mont. Kirkpatrick Bros. & Collins are making preparations to commence work on a short extension northwest from Sheridan, and this fact has probably given rise to the reports.

COOS BAY, ROSEBURG & EASTERN.—Work on this road in Oregon is being pushed forward as rapidly as possible. The cars are now running to Coquille City, from Marshfield, 18 miles, and for some distance above Coquille City. The company expects to complete the road to Myrtle Point, 9 miles above Coquille City, by August, and will continue toward Roseburg this fall. The distance from Myrtle Point to Roseburg is about 60 miles, with the Coast Mountains intervening, so it is considered hardly probable that the road will reach Roseburg before another year, unless the people of Roseburg will raise subsidy sufficient to enable the company to commence the grading from that end of the route.

FLORENCE & CRIPPLE CREEK.—Bids were received June 10 for the construction of this road between Florence and Cripple Creek, Colo., 34 miles in length. The grade is reported as not going over 2° until it reaches the outskirts of the mining district. The contract for steel rails has been awarded to the Bessemer Steel Works, Pueblo, and the road is expected to be finished within six months.

PECOS VALLEY.—It is reported that contracts will soon be awarded for the construction of this road between Eddy and Roswell, N. Mex. The line will probably be continued from Roswell to connect with the Atchison, Topeka & Santa Fe, at Bernal, or elsewhere.

Projects and Surveys.

GOLDEN GATE RY. CO.—Incorporated in Oregon by W. S. Campbell, Rochester, N. Y.; John Manning, Portland, Ore.; G. L. Moorehead, Junction City, Ore.; W. G. Prickett, Dallas, Tex.; G. W. Prickett, Eugene, Ore.; capital stock, $25,000,000; principal office, Portland, Ore.

UTAH & WYOMING.—The construction of this road between Casper, Wyo., and Ogden, Utah, about 300 miles, is reported as about to be commenced. Casper is the present terminus of the Fremont, Elkhorn & Missouri Valley Ry. The project also includes a branch south to Rawlins, Wyo., on the Union Pacific, and northwesterly to Lander in the direction of Yellowstone Park. Chief Engr., John B. Taylor, Salt Lake City.

Foreign.

GUATEMALA.—Dr. de la Carto, an envoy of the Guatemalan government, is reported as in this country trying to float $7,000,000 of 6% bonds guaranteed by the state to build a road from 200 to 300 miles long to complete a continuous line across the republic from San Jose de Guatemala on the Pacific coast to Port Barrios on the coast of the Gulf of Mexico. A road has been in operation for some time between San Jose de Guatemala and Guatemala City, and a line has also been built from Port Barrios 41 miles west.

MEXICO.—The concession and plans and specifications of the belt road to be constructed around the City of Mexico have been approved by the board of public works, and the time for the completion of the line extended to December, 1895. The construction will begin at once.

STREET RAILWAYS.

BANGOR, ME.—A project is under consideration for building an electric road, to be operated from the same water power as that for the Bangor Street Ry. connecting the cities of Bangor and Old Town, a distance of about 12 miles. This road will encounter grades of 8% for a distance of 1,000 ft.

ROCKLAND, ME.—Residents of Rockville and West Rockport are making efforts to have the electric road extended to those towns. G. P. Burgess, Rockport, is interested.

HOLYOKE, MASS.—The Holyoke St. Ry. Co. is reported as considering a scheme for building an electric road to the summit of Mount Tom.

NEWBURYPORT, MASS.—The People's St. Ry. Co. has been organized and elected the following officers: Pres., F. S. Carr, West Newbury; Treas, H. O. Delano,, Merrimac; Clk., F. W. Noyes, West Newbury. Considerable stock has already been subscribed, and it is reported that an electric road will be built this summer between Newburyport and West Newbury.

WORCESTER, MASS.—The Worcester, Leicester & Spencer St. Ry. has voted to extend a branch line to Stoneville, about 1½ miles distant.

BRIDGEPORT, CONN.—It is reported that an application for a charter for the Southport Tramway Co. will be withdrawn, and that the Bridgeport Horse R. R. Co. will build a line to Southport within two years.

HARTFORD, CONN.—The Hartford & Wethersfield Horse R. R Co. has petitioned for permission to extend its lines and to use the trolley. The Senate has passed bills incorporating the Shelton St. Ry. Co., of Huntington; New Haven St. Ry. Co. and the Groton Surface Ry.

HOOSICK FALLS, N. Y.—The town board has authorized the granting of a franchise to the Hoosick Ry. Co., which has been incorporated by G. C. Moses and F. H. Twitchell, Bath, Me.; W. M. Holmes, Jos. Buckley and others, of this place, to construct an electric road in this village and to Wallomsac, a distance of about four miles; capital stock, $60,000.

KINGSTON, N. Y.—The Colonial City Electric Ry. Co. has been incorporated to construct a road six miles long; capital stock, $175,000; Chas. W. Deyo, E. G. Lawrence and E. G. Loughran are among the directors.

MIDDLETOWN, N. Y.—The Middletown-Goshen Traction Co. has been incorporated to construct a road about ten miles in length; capital stock, $100,000; B. F. Low and A. D. Seaman, Middletown; E. A. Wightman and others, Scranton, Pa.

BRIDGETON, N. J.—J. P. Newbold and Walter Bacon are procuring signatures along the route between this place, Fairton and Cedarville, of property owners who desire an electric road.

BETHLEHEM, PA.—The town council has passed on second reading an ordinance granting the Bethlehem & Catasauqua Traction Co. right of way in town on condition that the tracks shall be first completed from Catasauqua to this place before ground is broken for the new road here.

CHESTER, PA.—The incorporation of the Peoples' St. Ry. was noted last week. It is reported that the company will build a road seven miles in length, including an extension to Upland, thence to Bridgewater, Knowlton, Village Green, Rockdale and Glen Riddle. There are now operated by the Union Ry., from the power house in this city, 26 miles of road, and the Chester, Darby & Philadelphia line, the contracts for which have been awarded, will be nine miles in length. Another line is in contemplation to extend from this city to points on the Middletown & Edgmont road, and the Wilmington system is being extended toward the city and will soon cross the state line.

MAHANOY CITY, PA.—The council is considering petitions from the following companies for franchises: Beaver, Beaver Meadow, Hazleton, Mahanoy City & Shenandoah Ry. Co., Mahanoy & Shenandoah Ry. Co., Lakeside Electric Ry. Co. Action has been deferred until June 20.

MILLVILLE, PA.—The council is reported as trying to arrange for an extension of the Allegheny & Manchester road to this place.

TURTLE CREEK, PA.—The council has granted the right of way to the Braddock & Turtle Creek Electric Ry. Co. and the Turtle Creek Valley Electric Ry. Co. The line will extend over the Braddock road, through Versailles township to the borough line, over Penn. Ave. to Westinghouse Ave. and thence to Wilmerding. The tracks must be completed by Oct. 8.

PHILADELPHIA, PA.—The council has passed an ordinance granting a franchise to the Delaware & Schuylkill Electric Co. for the section of the city from Tacony, through Frankfort and Germantown to West Philadelphia.

FREDERICK, MD.—It is reported that the construction of the Frederick and Middletown electric road will be commenced within a few days. Pres. L. N. Downs, New York; Vice-Pres., Upton A. Sharretts, Frederick. A road is being discussed from Gettsburg, Pa., by way of Emmitsburg, Mechanicstown and this city, to Washington.

CHARLESTON, W. VA.—A 40-year franchise has been granted to the railway company to construct an electric line.

JACKSONVILLE, FLA.—John E. Hartridge, of the Jacksonville St. Ry. Co., is reported as stating that the line will be changed to the trolley system by next January.

CINCINNATI, O.—The Cincinnati Inclined Plane Ry. Co. is making preparations for the extension of its electric line northwardly from the Fair Grounds at Carthage, O., two miles through the village of Hartwell to Lockland, O.

YOUNGSTOWN, O.—An electric road is projected to Girard, a distance of 3½ miles; estimated cost, $50,000. John E. McVey is interested.

MUNCIE, IND.—It is reported that the right of way has been secured for an electric railway between this city and Eaton, a distance of 12 miles, and that it is proposed to extend the road ten miles beyond Eaton to Hartford City. The construction is reported as to be soon commenced.

ST. LOUIS, MO.—The county court has granted a franchise to the Midland Electric Ry. Co. to extend its line to Creve Couer Lake, and thence to the Missouri River. The company that is to construct the road was recently incorporated as the Midland Construction Co.

SAN JOSE, CAL.—The trustees will soon sell a franchise for an electric road.

TORONTO, ONT.—The Penetanguishene & Midland Electric St. Ry., Light & Power Co., has been incorporated by C. Beck, J. F. Beck and others; capital stock, $75,000.

HIGHWAYS.

IDAHO.—The state wagon road commissioners met June 1 and organized by electing the following officers: Chn., J. R. Sharp, of Custer county; Secy., W. P. Ball, of Nez Perces county. The commission has a $135,000 appropriation to spend in building a road to connect the northern and southern portions of the state.

CALIFORNIA.—The Kiamath wagon road bonds voted by Humboldt county at the general election have been decided good and will be sold at once and the road built.

BRIDGES.

BRIDGEPORT, CONN.—The county commissioners will receive bids until June 29 for a bridge over the Housatonic River. Full particulars are given in our advertising columns.

TOWNSEND, DEL.—Plans have been prepared for a bridge over Blackbird Creek, to cost about $4,000.

WARREN CO., MISS.—The board of supervisors have decided to build a second river swing bridge over Big Lake.

BENTON HARBOR, MICH.—The Royalton Bridge Co. has been chartered with a capital of $10,000.

DEPERE, WIS.—Bids will be received until June 26 for a steel bridge across Fox River. J. S. Chase, Chn. Com.; Oscar Sanne, Consult. Engr., Milwaukee.

CHICAGO, ILL.—The Lincoln Park Board has adopted plans prepared by Mr. W. L. Stebbings, Cons. Engr., Monadnock Block, Chicago, for an arched bridge across the lagoon to connect the park proper with the lake shore drive. It will consist of one 170-ft. span, two 75-ft. spans and approaches. Mr. Stebbings has been retained to let all contracts and to superintend the construction.

ST. LOUIS, MO.—An ordinance appropriating $100,000 for a new bridge over the railroad at Twelfth St. will probably be introduced in the Assembly early next term. The first steps toward getting a new structure have been taken by introducing an ordinance in the Board of Public Improvements establishing a new grade for the thoroughfare. The grade must be established by law before the bridge can be built. An ordinance will also be necessary to condemn the old bridge and assess the cost of the new structure against the railroads, both over and under the structure. The new bridge will cost in the neighborhood of $175,000 Of this the railroads will be obliged to pay about $75,000. The bridge will extend from the south line of Spruce St. to the north line of Chouteau Ave., and will be as wide as the Grand Ave. bridge.

KANSAS CITY, MO.—Bids will be received until June 19 for constructing a viaduct connecting Bluff St. and St. Louis Ave. Cy. Engr., John Donnelly.

ST. HELENS, ORE.—Bids are asked until July 5 for a county bridge across the Nehalem River. Dean Blanchard, County Judge.

SALINAS, CAL.—The supervisors of Monterey county will receive bids until June 30 for a bridge across San Lorenzo Creek, near Kings City.

COBOURG, ONT.—Bids will be received until June 26 for constructing a 130-ft. fixed and a 100-ft. swing span, with masonry substructure. Neil F. Macnachtan, Cy. Clk., Cobourg, Ont.

WATER-WORKS.

HANOVER, N. H.—The recent meeting, at which it was unanimously voted to raise $20,000 for a supply, has been declared illegal and another meeting will be held June 23.

MEREDITH, N. H.—The commissioners will receive bids until June 29 for a 5,500,000-gallon reservoir and about five miles of pipe.

BENNINGTON, VT.—A meeting will be held June 17 to vote on the purchase of the franchise and works of the Bennington Water Co.

BOSTON, MASS.—The aldermen have voted to authorize the water board to construct a tower and pumping station in Charleston of sufficient capacity to supply the Charleston high service district.

FALL RIVER, MASS.—The council has voted in favor of extensions in a large number of streets.

METHUEN, MASS.—A special meeting has been called for June 14 to vote on the construction of works.

NEW BEDFORD, MASS.—The water board has granted petitions for about 2,000 ft. of mains.

ROCKVILLE, CONN.—The city and the Rockville Aqueduct Co. have agreed to engage Mr. Ayres, Hartford to decide upon the size of mains and location necessary to give the city a sufficient supply, including a high-pressure service. The survey will be made as soon as possible.

JEFFERSON, N. Y.—The contract for trenching and pipelaying has been awarded to D. A. Leley & Son, Jefferson, at $3.18 per rod (about 19 cts. per ft.), work to be completed by Aug. 15. The contract for drawing the pipe, 75 tons, from Stamford, has been awarded to Bishop Mann, at $1.48 per ton. The contract for dam and reservoir has not been awarded.

MADISON BARRACKS, N. Y.—The contract for extensions has been awarded to John Morsden, Utica, at $31,000, the other bids being as follows: Entire work, Moffett, Hodgkins & Clarke, New York, $35,392; for supply main, W. J. Semper, Watertown, $25,993; Richard Dawson and W. J. Dwyer, $22,841.

MIDDLETOWN, N. Y.—The board will replace about two miles of 6 and 4-in. cement pipe with iron pipe.

NEW YORK, N. Y.—The aqueduct commissioners will receive bids until June 28 for cutting timber and clearing grounds on Titicus River for reservoir M, near Purdy's Station, in North Salem. The commissioners have directed the construction of a reservoir within the city limits, north of the Harlem River, and have reported that at Jerome Park a reservoir could be constructed that would store 1,500,000,000 gallons. The Commissioner of Public Works has been requested to submit plans, specifications and estimates for such a reservoir.

NIAGARA FALLS, N. Y.—At an election June 7 bonds for $50,000 were voted for extensions of the works supplying the Suspension Bridge section.

HIGHTSTOWN, N. J.—Surveys for works will be made at once by Focht & Herbert, Bound Brook.

LORRAINE, N.J. (Roselle P. O.)—The Lorraine Water Co. has been incorporated and pipes will be laid at once, the water being supplied from the mains of the Union County Water Co.; Pres., S. D. Drake; Vice-Pres., F. M. Fowler; Treas., A. D. Thompson, Plainfield; Secy., L. L. Drake.

NEWTON, N. J.—Works are being discussed.

BRADFORD, PA.—All bids for the reservoir and pipe have been rejected. Extensions have been ordered providing for 14 to 4-in. pipe.

McKEES ROCKS, PA.—Bonds for $50,000 for works have been voted and will be issued at once.

MYERSDALE, PA.—Surveys will be made for an additional supply.

PHILADELPHIA, PA.—The city has awarded the contract for the additional pumping engines for the Spring Garden pumping station, on which proposals were received April 25, to the Holly Mfg. Co., Lockport, N. Y., on its bid for two vertical triple compound pumping engines, each of 30,000,000 gallons daily capacity. One of the engines is to be completed within twelve months from contract date, and the other within fifteen months. The engines are guaranteed to perform a test duty of 125,000,000 ft.-lbs. The contract price is $162,570. It is reported that the Mayor has been authorized to spend $5,000 for having the Perkiomen Valley surveyed for a distance of 100 miles, with a view to providing for a new supply.

CUMBERLAND, MD.—The City Clerk has been authorized to prepare $100,000 of 4% bonds for the improvement of the water supply of the city.

FREDERICK, MD.—The contract for a 6,000,000-gallon reservoir has been awarded to Lane Bros., Morgantown, W. Va., at $14,901.

MACON, GA.—The Macon Gas Light & Water Co. offers to sell its water plant for $550,000. J. W. Wilcox, ex-Supt. of this company, estimates that with the Ocmulgee River as a source of supply works can be constructed for $228,599; estimating 33¾ miles of mains, at $141,875; reservoir, $28,000; stand-pipe, $11,700; river station, $33,400.

WAYCROSS, GA.—The council has voted to arrange at once for the completion of two artesian wells, and it is reported that Joyce & Co., Philadelphia, will probably be awarded the contract. The city has spent $29,300 for works, exclusive of the wells. The present supply is received from the Satilla Mfg. Co., and is not intended for household purposes.

MORRISTOWN, TENN.—An election will be held July 5 to vote on the issue of bonds for works. The mayor has been authorized to employ an engineer to make surveys for a $40,000 system.

CYNTHIANA, KY.—The city clerk will receive bids until July 1 for a franchise.

FALMOUTH, KY.—The city council has granted a franchise to a local company.

CINCINNATI, O.—Improvements have been ordered, estimated to cost $653,631. For a pump for the Front St. pumping station, the Laidlaw-Dun-Gordon Co. bid $35,780 and the Wilson-Snyder Co., $39,780. Both bids have been rejected and new specifications ordered.

MINGO, O.—The council is reported as discussing works.

ORRVILLE, O.—H. S. Wertz, Vil. Clk., writes us that Alexander Potter, New York, has been engaged by the village to make plans and specifications for and also to superintend the construction of a system of water-works. A pumping system will be used. Bids will be received for this work by the end of June, notice of which will be given later.

WYOMING, O.—The village will spend about $5,000 on extensions of mains and the erection of a watchman's house at the reservoir.

PORT HURON, MICH.—The commissioners will receive bids until June 21 for 450 tons of 12 to 4-in. cast iron pipe and 8 tons of special castings.

SAGINAW, MICH.—The committee has recommended that additional machinery be purchased for the west side station and extensions made, and that an election be held to vote on the issue of bonds for $100,000 for this purpose.

ATLANTA, ILL.—The contract for furnishing and laying mains has been awarded to H. Marshall, Lincoln, at 60 and 46 cts. per lin. ft. for 6 and 4-in. pipe, respectively.

CENTRALIA, ILL.—All bids for works have been rejected and new specifications have been ordered.

CHICAGO, ILL.—The commissioner of public works has been directed to advertise for bids for 36 to 16-in. mains, estimated to cost $231,000; also for 24-in. mains for the northwest section of the city.

PANA, ILL.—John W. Hill, Cincinnati, has been engaged to prepare plans, estimates and specifications for works.

ASHLAND, WIS.—The water of Chequamegon Bay is not satisfactory and it is reported that a supply will be secured form some 50 springs west of the city.

BERLIN, WIS.—The aldermen are investigating the question of works.

SOUTH MILWAUKEE, WIS.—The Milwaukee Suburban Water Co. has been incorporated by C. E. Gray, T. W. Gray and J. R. Gray; capital stock, $100,000.

SIOUX CITY, IA.—The city engineer has been directed to prepare surveys and estimates for works for the Morning Side section.

GRANITE FALLS, MINN.—Bonds for $8,000 are proposed for extensions.

SPRING VALLEY, MINN.—Bids were received June 9 for $10,000 of bonds for works.

WASECA, MINN.—June 6 the citizens voted in favor of issuing bonds for works.

AUBURN, NEB.—Steps are being taken for works.

CEDAR RAPIDS, NEB.—June 5 the citizens voted in favor of issuing bonds to put in works.

EUREKA, S. DAK.—Works are being discussed.

CASPER, WYO.—It is reported that works will be put in this year.

AMARILLO, TEX.—The city will soon construct works, according to reports.

EDNA, TEX.—Jos. Gerst has submitted a proposition to supply the business portion of the town with works.

COLORADO CITY, COLO.—The question of municipal works is being agitated by the local press.

NEW CASTLE, COLO.—Bids were received June 5 for pipe and pipe laying. Land will be purchased for reservoir.

SANTA FE, N. MEX.—The Santa Fe Water Co. has been incorporated by J. M. Howells, Chicago; S. H. Day, San Jose, Cal.; L. F. Hughes and others of this city; capital stock, $500,000. These incorporators are also interested in the company which has recently spent $100,000 in improving the system in that city. It is reported the new company proposes a canal 20 miles long to the Rio Nambe River.

KINGFISHER, OKLA.—It is reported that the city will put in works.

PASCO, WASH.—H. M. McCartney and others, Salt Lake City, have been granted a franchise for works.

SEATTLE, WASH.—W. Kiersted, Kansas City, Mo., is preparing surveys and estimates for works. A gravity supply is proposed from Mill Creek.

WALLA WALLA, WASH.—Plans have been made for works, and an election will be held next month to vote on the question of bonds.

COLTON, CAL.—The West Riverside Land & Water Co. has been incorporated; capital stock, $5,000.

COVINA, CAL.—The Covina Water Co. has been incorporated by C. E. Bemis, J. K. Basho, J. D. Madden and others; capital stock, $10,000.

ELK GROVE, CAL.—The Elk Grove Water Co. has been incorporated; capital stock, $5,000.

WINDSOR, ONT.—The aldermen have voted to authorize the commissioners to spend $55,000 in extending the intake pipe above Walkerville.

ARTESIAN WELLS.

JACKSON, MICH.—The board of public works has petitioned for authority to construct a 10-in. well, 112 ft. deep, for fire protection.

IRRIGATION.

WHITEWATER, COLO.—The Juniata Reservoir Co. has been incorporated with a capital stock of $5,000.

FRESNO, CAL.—It is reported that contracts have been awarded for the irrigation of 80,000 acres in Madera county. The water is to be taken form the Kings River, in Fresno county, and conducted by canals to near the San Jaquin River, which will be crossed by an aqueduct.

SAN FRANCISCO, CAL.—The Baja-California Land, Water & Commercial Co. has been incorporated by P. Olandins, W. Neumann, W. S. T. Schenck and others; capital stock, $250,000.

SEWERS.

PORTLAND, ME.—Geo. N. Fernald, Cy. Engr., informs us that bids will be received until June 21 for 1,500 ft. of 15 and 12-in. pipe sewer, average cut 5½ ft., and that plans have been prepared for 1,015 ft. of brick sewer, 60 × 75 ins., average cut 7½ ft.; estimated cost, $9,500.

NASHUA, N. H.—The city engineer is preparing plans for a brick sewer, 28-in. to 30×45 ins., 3,500 ft. in length.

BOSTON, MASS.—Plans have been prepared for sewering Faneuil Hall market; estimated cost, $10,000.

BROCKTON, MASS.—The city council has authorized a sewerage loan of $240,000.

CLINTON, MASS.—The town has voted $8,000 for sewers.

EASTHAMPTON, MASS.—The commissioners will receive bids until June 17 for construction of sewers.

FALL RIVER, MASS.—Sewers have been ordered in 18 streets.

MEDFORD, MASS.—The city has been authorized to borrow $350,000 outside of the debt limit to construct a system in connection with the metropolitan system of Boston.

PLYMOUTH, MASS.—Chas. B. Stoddard, Jas. B. Collingwood and Geo. W. Bradford have been appointed a sewer committee.

EAST PROVIDENCE, R. I.—Walter M. Dexter, J. P. Millard and W. L. Pierce have been appointed members of a sewer commission.

LINCOLN, R. I. (P. O. Central Falls).—The sewer commissioners will recommend a special appropriation for a system; estimated cost, $40,658.

BRISTOL, CONN.—Wm. Linstead, W. S. Ingraham and G. S. Hull have been appointed a committee to investigate the question of sewers.

HARTFORD, CONN.—Rudolph Hering has submitted plans for a system, which provide for taking the sewage out of Park River and Gully Brook, and a comprehensive system of cut-off sewers. A report will be given at the next council meeting, June 26.

ILION, N. Y.—The following bids have been received for the proposed system: P. H. Harrison & Sons, Newark, N. J., $37,710; M. Sullivan, Little Falls, $50,737; Le Valley & Jenkins, Elmira, $51,876; Beckwith & Quackenbush, Herkimer, $57,576; John Wilson, Herkimer, $57,782; Conover & Newton, Orange, N. J., $62,684; John F. Thomas, Ilion, $65,000; Wm. Grant Cook, New York, $66,876; Scripture & Morris, Watertown, $67,388; J. J. Rumsey, Fostoria, O., $71,525. The contract has not yet been awarded. The estimate of the Stanwix Engineering Co., Rome, engineers for the work, was about $50,000.

NEW YORK, N. Y.—Bids will be received until June 20 for four sewers in wards 23 and 24. It is reported that $1,000,000 will be spent this year in extensions in these two wards.

BRIDGETON, N. J.—A committee has been appointed to secure signers to petitions for the issue of bonds for a system. Ed. M. Fithian is interested.

FLEMINGTON, N. J.—Surveys and plans for a system are being made by Focht & Herbert, Bound Brook.

BRADFORD, PA.—The city clerk has been instructed to advertise for bids for a sewer in two districts.

EMPORIUM, PA.—It is reported that a system will be constructed to cost $45,000.

HAZLETON, PA.—Ordinances have been passed for three sewers.

LOCK HAVEN, PA.—The council is advertising for bids for surveys and plans for a system.

MEADVILLE, PA.—It is reported that plans are nearly completed for a system.

TITUSVILLE, PA.—Surveys are being made by Jos. Smith, Cy. Engr. for important extensions.

WILMINGTON, DEL.—The only bid received for 11,000 ft. of sewers was that of John Jacoby. No action was taken.

CARTHAGE, O.—Bids will be received until June 20 for 1,544 ft. of 15-in. and 1,168 ft. of 10-in. pipe sewers. T. C. Frost, Vil. Clk.; E. F. Layman, Engr., Cincinnati.

CLEVELAND, O.—Bids are asked until June 21 for sewers in seven streets. J. H. Farley, Dir. Pub. Wks. The following bids were received for a sewer in Holton Ave.: The Clements Bros. Const. Co., $31,463; McCarthy & Sager, $29,336; W. J. Gawn, $32,860; Campbell Bros., $34,153; Smith & Helm, $33,467.

WELLSVILLE, O.—The council is considering an offer from Alexander Potter, New York, for plans for a system.

HUNTINGTON, IND.—H. H. Wagoner, Cy. Engr., informs us that surveys are being made for a system but that it will probably be eight or ten months before the work will be completed ready for construction.

BATTLE CREEK, MICH.—Sewers are proposed for construction this year to cost over $30,000.

SAGINAW, MICH.—Contracts have been awarded for about $34,000 worth of sewers, the bids for the sewer in one street being as follows: D. A. Lamson, $14,705; Alfred Davies, $12,894; C. Davies, $12,286; Geo. Davies, $12,035.

CHICAGO, ILL.—It is reported that bids will soon be asked for the Wentworth Ave. sewer.

PANA, ILL.—John W. Hill, Cincinnati, has been engaged to prepare plans for a system.

GREEN BAY, WIS.—The committee has recommended sewers in several streets.

RHINELANDER, WIS.—It is reported that contracts are about to be let for a system.

SOUTH MILWAUKEE, WIS.—The citizens have voted to construct a system.

BURLINGTON, IA.—Bids will be asked for a sewer in Osborn St.

DULUTH, MINN.—The board of public works will receive bids until June 23 for three sewers, and until June 19 for one.

LEAVENWORTH, KAN.—The council has adopted resolutions to build several pipe sewers.

LIVINGSTON, MONT.—The question of a system is being considered by the council.

ST. JOSEPH, MO.—The council proposes to vote $20,000 for an extension if the railway company will pay an equal amount.

KANSAS CITY, MO.—The contract for the Goose-neck Creek sewer has been awarded to Cotter, McDonnell & Co., at $77,896.

PALESTINE, TEX.—We are informed that work on the system has been suspended, and the project practically abandoned.

FORT COLLINS, COLO.—The secretary of the Agricultural College will receive bids until July 1 for two miles of sewers, 5 to 14-ft. cut. D. W. Working.

SEATTLE, WASH.—The citizens have voted to issue bonds for $345,000 for sewers, including $95,000 for the completion of the Lake Union sewer tunnel.

SALINAS, CAL.—C. E. Grunsky has prepared plans for a system, including 10,300 ft. of 14-in. and 8,000 ft. of 16-in. pipe.

STREETS.

PORTLAND, ME.—Bids are asked until June 21 for grading, including 4,800 cu. yds. earth excavation, 1,298 sq. yds. cobblestone gutters, and surfacing driveways and walks with gravel; estimated cost, $4,500. Geo N. Fernald, Cy. Engr.

BOSTON, MASS.—The aldermen have appropriated $260,500 for widening Essex and Lincoln Sts.

DEDHAM, MASS.—The selectmen will receive bids until June 21 for about 6,000 sq. yds. of concrete walks.

ALBANY, N. Y.—The city engineer has prepared estimates for paving, to cost $115,750.

BUFFALO, N. Y.—For paving in two streets with asphalt, the Barber Asphalt Paving Co. bid $16,994 and $35,339, and the German Rock Asphalt Paving Co., $17,166 and $35,515, respectively.

NEW YORK, N. Y.—The commissioner of public works will receive bids until June 20 for nine contracts for flagging and grading.

SYRACUSE, N. Y.—For paving in Tallman St. with brick, John M. Mack & Co. bid $13,176 and W. G. Sprague $13,615.

TONAWANDA, N. Y.—The proposed paving in Canal St. is estimated to cost about $140,000.

NEWARK, N. J.—Bids are asked until June 20 for about 19,000 sq. yds. stone paving, six contracts. Chas. Marsh, Supt. Wks. Ordinances have been passed for additional work.

CARBONDALE, PA.—A contract for paving with brick has been awarded to Wm. Dunn, at about $15,000.

CHAMBERSBURG, PA.—The inspectors have reported 114 bad pavements, all of which have been ordered repaired.

OAKLAND, MD.—The town council has decided to employ an engineer to establish grade, set curbs and replace wooden sidewalks with brick pavement.

WASHINGTON, D. C.—After July 1 work will be commenced upon resurfacing streets, under an appropriation of $150,000 for this purpose.

NEW ORLEANS, LA.—Bids will soon be asked for paving with gravel and granite.

NEWPORT, KY.—The city engineer has been instructed to re-advertise for bids for paving with asphalt and brick two streets for which bids were recently received for paving with brick.

CINCINNATI, O.—The board of administration will receive bids until June 29 and July 5 for paving with brick.

CLEVELAND, O.—The Northern Ohio Paving & Const. Co. was the lowest bidder for five contracts, at about $60,000.

COLUMBUS, O.—The city engineer estimates proposed paving in High St. at $28,240 for brick, $40,520 for asphalt, or $40,730 for stone blocks.

DAYTON, O.—Additional paving has been ordered, to cost about $100,000.

MANSFIELD, O.—The city clerk will receive bids until July 1 for street improvements.

TOLEDO, O.—The city clerk will receive bids until June 19 and 26 for grading and paving.

CRAWFORDSVILLE, IND.—Bids are asked until June 26 for street improvements, including brick walks, stone gutters and grading. J. M. Waugh, Cy. Engr.

FORT WAYNE, IND.—Bids are asked until June 27 for brick sidewalks, stone curbing, etc. F. M. Randall, Cy. Engr.

INDIANAPOLIS, IND.—A contract for paving with asphalt will be awarded June 27. Several streets have been ordered paved.

JEFFERSON, IND.—The city engineer has prepared plans for the proposed improvement of Indiana Ave.

MONTPELIER, IND.—The town clerk will receive bids until June 20 for paving two streets with telford macadam.

ALLEGAN, MICH.—The question of paving the business streets is being discussed.

GRAND RAPIDS, MICH.—Contracts for street improvements have been awarded to Vissner & Sparman, at $8,491; H. Wagenmaker, at $7,575, and the Grand Rapids Paving & Supply Co., at $13,500. Estimates have been prepared for additional work.

LANSING, MICH.—Brick paving is being discussed.

STREATOR, ILL.—Bids are asked until July 3 for about 14 contracts. W. J. Zilm, Cy. Clk.

MINNEAPOLIS, MINN.—The proposed east side boulevard is estimated to cost about $101,000.

DEADWOOD, S. DAK.—There is talk of macadamizing the principal streets.

ELECTRIC LIGHT AND POWER.

NEW BEDFORD, MASS.—The superintendent of water-works has been instructed to place an electric light plant at the pumping station; capacity, about 75 lights.

JAMESTOWN, N. Y.—The Consumers' Arc Light & Power Co. is being organized to utilize the water power at Dexterville in generating electricity. The plant will be located on the old grist mill site, the flume deepened and enlarged, and the tail race lowered in order to give a 20-ft. head. Engineers have estimated the capacity of the dam to be 3,000 HP.

SCHAGHTICOKE, N. Y.—The Schaghticoke Powder Co. has voted to use electric power in its mills.

ATLANTIC CITY, N. J.—The bids for electric lighting have been rejected for a second time by the council. The lighting committee has been authorized to offer 35 cts. per light per night.

NEWTON, N. J.—The local gas company has shut off the town lamps and the citizens are agitating an electric plant.

McDONALD, PA.—Robt. J. Cook, Clk. of Council, informs us that a company is being organized to put in an electric light plant; estimated cost, $8,000.

BERKLEY, VA.—The Berkley & South Norfolk Water and Electric Light Co. has petitioned for authority to equip and operate a plant.

BELLE PLAINE, IA.—Bids will be received until June 26 for a franchise for at least 20 arc lights. F. W. Brown, Cy. Clk.

AMARILLO, TEX.—A municipal lighting plant is proposed.

HALLETSVILLE, TEX.—The city secretary has been instructed to investigate the exchanging of the present dynamo for a larger one.

LITTLE FALLS, WASH.—The Washington Fire Brick & Sewer Pipe Co. will build a dam to generate electricity for lighting and street car plant, which the company is reported as intending to put in soon.

EASTLAND, CAL.—W. F. C. Hasson is preparing specifications for a plant at this place for about 1,000 incandescent lights.

NEW COMPANIES.—Higgins Gravity Motor & Electric Gravity Clock Co., Chicago, Ill.; $1,000,000; George C. Higgins, S. L. Smith, Joes L. Squier.—City Electrical Co., Chicago, Ill.; $100,000; Marcin Bergman, P. P. Schaffer, Joseph Kastner.—Miamisburg Electric Co., Miamisburg, O.; $100,000.—Twin City General Electric Co., Ironwood, Mich., $400,000.—Palouse Electric Co., Palouse, Wash.; $30,000.—Milford Electric Light & Power Transmission Co., Milford, Ill.; $15,000.—Ida Grove Electric Co., Ida Grove, Ia.; $15,000.—Keewatin Power Co., Toronto, Ont.; $1,000,000; to furnish hydraulic and electric power from the Winnipeg River; Alex. Fraser, Westmeath; Wm. Gibson, Hamilton; John Mather, Ottawa.

CONTRACT PRICES.

ARTIFICIAL STONE WALKS.—Carthage, O.—The contract for constructing artificial stone sidewalks, four feet wide, in two streets, has been awarded to the Bader Artificial Stone Co., Cincinnati, at 54 cts. per lin. ft. E. F. Layman, Engr.

Columbus, O.—The contract for new artificial stone sidewalks in the Capitol grounds has been awarded to the Standard Paving Co., Columbus, at 12 cts. per sq. ft.

Lansing, Mich.—The Lansing Artificial Stone Co. has been awarded contract for artificial stone walks in the city at 10 cts. per sq. ft.

GRANITE BLOCKS.—Baltimore, Md.—Contracts for granite paving blocks have been awarded to Jas. G. Miller, at $60 per M., and to Henry J. Langtry, at $61 per M.

Fall River, Mass.—A contract for 160,000 granite paving blocks has been awarded to the Pigeon Hill Granite Co., Rockport, at $71 per M. Last year the city purchased 200,000 at $73.40 per M. The specifications call for blocks 10 to 14 ins. long, 3½ to 4½ ins. wide and 7 to 8 ins. deep.

SEWERS.—Ishpeming, Mich.—We are informed by Melville S. Hawkins, Engr., that the contract for a sewer in district No. 1 has been awarded to A. Anderson, and that in district No. 5 to Cooper & Dorsey. The total bids were as follows: 1, Andrew Anderson, St. Paul, $10,147 for No. 1, and $12,030 for No. 5; 2, Muir Bros. & Nicholson, Port Huron, $10,660 and $12,177; 3, Cooper & Dorsey, Terre Haute, Ind., $10,681 and $10,469; 4, Foley & Connelly, Menominee, $12,756 and $13,364; 5, Kirkland & Starkey, Ishpeming, $13,207 and $14,560; 6, J. M. Lally, Detroit, $15,738 and $16,912. The prices were as follows for district No. 1:

			1.	2.	3.	4.	5.	6.
			$	$	$	$	$	$
24-in. brick,	540	lin. ft., at..	2.60	3.00	1.85	2.14	3.33	3.76
18-in. pipe,	135	" " ..	1 60	1.15	1.20	1.85	1.41	1.85
15-in. "	1,500	" " ..	0.90	0.85	0.90	1 20	1.02	1 44
12-in. "	2,982	" " ..	0.65	0.70	0.65	1.10	0.80	1.15
8-in. "	3,302	" " ..	0.54	0.48	0.55	0.72	0.74	0 85
Flush tanks,	14,	at.....	45.00	75 00	45.00	45 00	74.00	67.00
Manholes,	20	"	27.00	30.00	30.00	25.00	31.00	31.50
Lamp holes,	11	"	12.00	10.00	12 00	13.00	19.00	8.00
Catch basins,	60,	at.....	23.00	35.00	38.00	30.00	37.00	41.50

District No. 5.

36-in. brick,	780	lin. ft., at..	3.75	3.00	2.00	2.72	3 80	4.35
24-in. "	950	" " ..	3 25	3.00	1.85	2.14	3.33	3.70
18-in. pipe	350	" " ..	1.60	1.15	1.20	1.87	1.32	1.85
15-in. "	1,330	" " ..	1.00	0.85	0.85	1.42	1.02	1.38
12-in. "	1,730	" " ..	0.85	0.75	0.65	1.16	0.86	1.12
	555	" " ..	0.65	0.70	0.60	1.02	0.80	1.09
	1,715	" " ..	0.55	0.48	0 55	0.80	0.74	1.85
Flush tanks,	6,	at.....	45.00	35.00	45.00	45.00	74.00	67.00
Manholes,	24,	"	27.00	30.00	30.00	28.00	31.00	31.50
Lamp holes,	10,	"	12.00	10.00	12.00	13.00	19.00	8.00
Catch basins,	55,	at.....	23.00	35 00	38.00	30.00	37.00	41.50

MISCELLANEOUS.

LEVEE WORK.—New Orleans, La.—The Atchafalaya and Lafourche Basin levee districts will receive bids until July 3 for 1,000,000 cu. yds. of work.

WHARF REPAIRS.—Washington, D. C.—Bids will be received at Bureau of Yards and Docks until June 26 for repairs to wharf No. 6 at Boston navy yard. N. H. Farquhar, Ch. of Bureau.

DIKE WORK.—Philadelphia, Pa.—Bids will be received at the U. S. Engineer Office until July 5 for repairing and strengthening the pile and stone dike at Bulkhead Bar, Delaware River. Maj. C. W. Raymond, U. S. A.

PLANS FOR PARK IMPROVEMENT.—Providence, R. I.—It is expected that an engineer and two assistants will soon be employed to make surveys and plans for the improvement of Roger Williams, Blackstone and Davis parks.

CABLES, TRENCHING, ETC.—Baltimore, Md.—The fire commissioners will receive bids until Jan. 20 for furnishing the cables, trenching and laying new conduits where necessary for the underground wires of the police and fire alarm telegraph and the police patrol systems.

INDUSTRIAL NOTES.

LOCOMOTIVES.—The Brooks Locomotive Works, Dunkirk, N. Y., report 27 locomotives completed during May. They included 12 ten-wheel engines, with cylinders 19×26 ins.; 9 ten-wheel engines, 18×24 ins.; 2 eight-wheel, 16×24 ins.; 2 consolidation, 18×26 ins.; 1 four-wheel switching engine, 17×24 ins.; 1 six-coupled double-ender, 17×24 ins.

The Baldwin Locomotive Works, Philadelphia, Pa., have delivered 11 engines to the Monterey & Mexican Gulf.

The Schenectady Locomotive Works, Schenectady, N. Y., have an order for 2 consolidation engines for the Fall Brook.

The Rogers Locomotive Works, Paterson, N. J., are building 5 eight-wheel passenger engines and 7 ten-wheel freight engines for the Florida Central & Peninsular.

The Grant Locomotive Works, which made an assignment last week, have an order on hand for 55 engines for the Chicago, Burlington & Quincy.

CARS.—The Ensign Mfg. Co., Huntington, W. Va., has an order for 100 stock cars of 60,000-lbs. capacity, with M. C. B. couplers and Westinghouse brakes.

The Harrisburg Car Mfg. Co. has an order on hand for 50 box cars.

THE GRANT LOCOMOTIVE WORKS, Chicago, Ill., made an assignment June 6, but it is said the works will not be shut down. Liabilities, $410,950; assets, $1,151,020. The cause of the company's embarrassment is that it has been working upon a large order for locomotives, and they cannot be realized upon until delivered. As the company has been delayed and hindered in completing the locomotives by the strike which has been going on for the last three months, under the order of the International Association of Machinists, and as the financial condition of the money market has prevented the company from raising funds to bridge over the emergency, the stockholders decided that all parties interested would be protected by putting the property of the company in the hands of the assignees. The liabilities, aside from the mortgage of $200,000, consists of indebtedness for material used in the construction of locomotives. The company was at work on a contract to build 55 engines for the Chicago, Burlington & Quincy. This contract amounted to over $750,000, and when the strike took place all this money was tied up.

FAIRBANKS, MORSE & CO., Chicago, have an exhibit at the World's Columbian Exhibition which is made up of four divisions. One of windmills in the Agricultural Department, at the south end of the grounds; another of hoisting engines and mining steam pumps in the Mines and Mining Building; another, consisting of elevated tank with fixtures and automatic railway stand-pipe, with pump-house and pump and boiler combined, hand cars, railway tricycle, track jacks, wrecking frogs and rail drills, etc., at the north end of the Transportation Building annex; and another, perhaps the most elaborate, consisting of a full assortment of sizes and styles of Fairbanks scales, in the Manufactures Building.

THE HOLLY MFG. CO., Lockport, N. Y., has removed its New York office to the Havemeyer Building, corner of Cortlandt and Church Sts.

THE BUCYRUS STEAM SHOVEL & DREDGE CO., of South Milwaukee, Wis., has two exhibits at the World's Columbian Exhibition: one in the Transportation Building (Section X, columns 5 to 9), and the other in the Mines and Mining Building (southeast central section of ground floor, columns 0 to 22). The former consists of a small special placer amalgamator for saving gold. The latter includes one of the company's improved No. 1 steam shovels, a No. 4 steam shovel, and an 8-yd. dipper dredge bucket, which claims the distinction of being the largest in the world. There are also samples of the company's endless chain buckets, and a number of models of dredges.

INTERSTATE COMMERCE COMMISSION.

NOTICE TO COMMON CARRIERS OF THE STANDARD HEIGHT OF DRAWBARS.

At a General Session of the Interstate Commerce Commission, held at its office in the City of Washington, D. C., on the 6th day of June, A. D. 1893.

Present:

Hon. William R. Morrison, Chairman,
Hon. Wheelock G. Veazey,
Hon. Martin A. Knapp,
Hon. James W. McDill,
Hon. Judson C. Clements,
Commissioners.

Whereas, By the fifth section of an act of Congress, approved March 2, 1893, entitled, "An act to promote the safety of employees and travelers upon railroads by compelling common carriers engaged in interstate commerce to equip their cars with automatic couplers and continuous brakes and their locomotives with driving-wheel brakes, and for other purposes," it is provided, among other things, "That within ninety days from the passage of this act the American Railway Association is authorized hereby to designate to the Interstate Commerce Commission the standard height of drawbars for freight cars, measured perpendicular from the level of the tops of the rails to the centers of the drawbars, for each of the several gages of railroads in use in the United States, and shall fix a maximum variation from such standard height to be allowed between the drawbars of empty and loaded cars. Upon their determination being certified to the Interstate Commerce Commission, said commission shall at once give notice of the standard fixed upon to all common carriers, owners, or lessees engaged in interstate commerce in the United States by such means as the commission may deem proper." * * * * "And after July 1, 1895, no cars, either loaded or unloaded shall be used in interstate traffic which do not comply with the standard above provided for."

And Whereas, The said American Railway Association did thereafter, and within the period of 90 days after the passage of said act, to wit, on the 26th day of May, 1893, duly file with the Interstate Commerce Commission the certificate of their action, designation and determination in manner and form as follows, viz.:

THE AMERICAN RAILWAY ASSOCIATION.

Office of the Secretary, 24 Park Place,
New York May 22, 1893.

The Honorable, The Interstate Commerce Commission, Washington, D. C.

In compliance with the fifth section of an act of congress approved March 2, 1893, entitled "An act to promote the safety of employees and travelers upon railroads by compelling common carriers engaged in interstate commerce to equip their cars with autematic couplers and continuous brakes, and their locomotives with driving-wheel brakes, and for other purposes," the American Railway Association hereby certifies to your honorable body, that at its regular meeting held at Chicago on April 12, 1893, it adopted resolutions as follows:

Resolved, That the standard height of drawbars for freight cars, measured perpendicular from the level of the tops of the rails to the centers of the drawbars, for standard gage railroads in the United States, shall be 34½ ins., and the maximum variation from which standard height to be allowed between the drawbars of empty and loaded cars shall be three inches.

Resolved, That the standard height of drawbars for freight cars, measured perpendicular from the level of the tops of the rails to the centers of the drawbars, for the narrow gage railroads in the United States, shall be 26 ins., and the maximum variation from such standard height to be allowed between the drawbars of empty and loaded cars shall be three inches.

Witness:

The American Railway Association,
H. S. HAINES, President.
W. F. ALLEN, Secretary.

Now, Therefore, In pursuance of the provisions of said section five of said act.

It Is Ordered, That notice be at once given to all common carriers, owners or lessees engaged in interstate commerce in the United States, that the standard height of drawbars for freight cars, measured perpendicular from the level of the tops of the rails to the centers of the drawbars, has been designated and determined by the American Railway Association, mentioned in said act, as and to be 34½ ins. for standard gage railroads in the United States, and 26 ins. for narrow gage railroads in the United States; that the maximum variation from such standard height to be allowed between the drawbars of empty and loaded cars, both for standard and narrow gage railroads in the United States, has been fixed and determined by said association to the Interstate Commerce Commission, and that such determination has been duly certified by said association to the Interstate Commerce Commission.

And It Is Further Ordered, That such notice be given by mailing a copy of this order, with the recitals therein contained, attested by the seal of this Commission and the signature of its secretary, in a sealed envelope duly addressed to each known railroad carrier, in the United States, engaged in interstate commerce, whether owner or lessee, at its principal office or place of business, and by publishing the same at least once in each of the following named papers, viz.: The Railway Review, published at Chicago, Ill.; The Railway Age and Northwestern Railroader, published at Chicago, Ill.; The Railroad Gazette, published at New York, N. Y.; The American Engineer and Railroad Journal, published at New York, N. Y.; The Railway Equipment Guide, published at New York, N. Y.; The Travelers' Official Guide, published at New York, N. Y.; The Engineering News and American Railway Journal, published at New York, N. Y., and The Railroad Car Journal, published at New York, N. Y.

EDW. A. MOSELEY,
Secretary.

24-1t

PROPOSALS FOR STREET IMPROVEMENT.

Sealed proposals will be received by the Board of Councilmen of the City of Newport, Ky., at the council chamber, Thursday evening, June 29, 1893, until 8 o'clock, for the improvement by reconstruction and paving the roadway with brick or asphalt of Washington Ave., from Third St., to Eleventh St.; York St., from Third St. to Eighth St.; Isabella St., from Fourth St. to Ninth St.; Fourth St., from York St. to Brighton St.

Also for the improvement by reconstruction and macadamizing the roadway of Ninth St., from Mill St. to Norton St.

The work to be done in accordance with specifications on file in the office of the City Engineer, where copies of same and blank form of proposal and contract may be had.

The Board reserves the right to reject any or all bids.

B. MORTON,
City Engineer.

Newport, Ky., June 8, 1893. 24-2t

TO SEWER CONTRACTORS.

DAYTON, OHIO.

Office of the City Comptroller,
June 9, 1893.

Sealed proposals will be received at the office of the City Comptroller until 12 o'clock (noon) Monday, July 10th, 1893, for furnishing materials and constructing sewers and appurtenances in Sewer Districts Nos. 2, 3, 4 and 5, Dayton, O.

The work on which bids are solicited comprises about 4,016 lineal ft. of brick sewer, 40 ins. in diameter.

1,570 lineal ft. of brick sewer, 35 ins. in diameter.

750 lineal ft. of brick sewer, 30 ins. in diameter.

1,200 lineal ft. of brick sewer, 24 ins. in diameter.

300 lineal ft. of pipe sewer, 18 ins. in diameter.

1,500 lineal ft. of pipe sewer, 15 ins. in diameter.

4,400 lineal ft. of pipe sewer, 12 ins. in diameter.

6,520 lineal ft. of pipe sewer, 10 ins. in diameter.

49,055 lineal ft. of pipe sewer, 8 ins. in diameter.

100 lineal ft. of pipe sewer, 6 ins. in diameter.

3,600 lineal ft. of pipe sewer, 5 ins. in diameter.

15,700 lineal ft. of subsoil drains.

140 manholes.

79 flush tanks.

184 lampholes.

35 tons of iron pipe.

200,000 ft. (B. M.) of lumber, and other minor items.

A certified check on a National Bank for $2,500, payable to the order of the City Comptroller, will be required of each bidder as a guarantee that if any bid is accepted a contract will be entered into and the performance thereof properly secured.

The bond required of the successful bidder shall be in the sum of 50% of the contract price and must be given by residents of Montgomery County, Ohio, or said bond may be otherwise secured in a manner satisfactory to the Board of City Affairs, by whom said bond must be approved.

All bids must be made upon the printed forms to be obtained of the City Comptroller, and according to the directions therein contained.

The Board of City Affairs reserves the right to reject any or all bids, or waive defects in bids in the interest of the city.

Plans and specifications of the work are on file and may be seen at the office of the City Civil Engineer, and at the office of the Engineers of Sewers.

By direction of the Board of City Affairs.
J. H. WELLER,
President.

C. A. HERBIG,
City Comptroller.
CADY STALEY,
GEO. S. PIERSON,
Engineers.
Rooms 35 and 36 Chase Block,
Kalamazoo, Mich. 24-2t

TO SEWER CONTRACTORS.

DAYTON, OHIO.

Office of the City Comptroller,
June 9, 1893.

Sealed proposals will be received at the office of the City Comptroller until 12 o'clock (noon) Monday, July 10, 1893, for furnishing materials and constructing sewers, drains and appurtenances in sewer district number 8, Dayton, Ohio, and outlets thereto.

The work on which bids are solicited comprises about:

3,820 lineal ft. of sewer 12 ins. in diameter.

4,900 lineal ft. of sewer 10 ins. in diameter.

20,390 lineal ft. of sewer 8 ins. in diameter.

100 lineal ft. of sewer 6 ins. in diameter.

34,790 lineal ft. of subsoil drains.

63 manholes.

32 flush tanks.

36 tons of iron pipe. And other minor items.

A certified check on a National bank for $1,000, payable to the order of the city comptroller, will be required of each bidder as a guarantee that if any bid is accepted a contract will be entered into and the performance thereof properly secured.

The bond required of the successful bidder shall be in the sum of 50% of the contract price, and must be given by residents of Montgomery county, Ohio, or said bond may be otherwise secured in a manner satisfactory to the board of city affairs, by whom said bond must be approved.

All bids must be made upon the printed forms to be obtained of the city comptroller, and according to the directions therein contained.

The Board of City Affairs reserves the right to reject any or all bids, or waive defects in bids in the interest of the city.

Plans and specifications of the work are on file, and may be seen at the office of the City Civil Engineer, and at the office of the Engineers of Sewers.

By direction of the Board of City Affairs.
J. H. WELLER,
President.

C. A. HERBIG,
City Comptroller.
CADY STALEY,
GEO. S. PIERSON,
Engineers.
Room 36, Chase Block,
Kalamazoo, Mich. 24-2t

PROPOSAL FOR SEWER.

Oberlin, O., May 26, 1893.

Sealed proposals will be received by the Clerk of the village of Oberlin, Ohio, until 12 o'clock m., July 3, 1893, for furnishing and laying about 6,300 ft. 8-in. sewer pipe; 24,300 ft. 6-in. sewer pipe.

Also subsoil drains, specials, manholes, and other appurtenances, together with materials therefor.

Plans and specifications may be seen and blank proposals can be obtained at the office of the Engineer.

Bids for labor and material shall be separately stated, with the price thereof. Each proposal must contain the full name of the party or parties making the same and all parties interested therein, and must be accompanied by a certified check for $510 as a guarantee that a contract will be entered into.

No proposal will be entertained unless made on the blanks furnished by the Engineer and delivered to the Clerk previous to 12 o'clock m. on the day specified.

The Council reserves the right to reject any or all bids.

A. G. COMINGS, Mayor.
A. M. LOVELAND, Clerk.
24-2t W. B. GERRISH, Engineer.

NOTICE TO CONTRACTORS.

Office of the City Clerk,
Ashtabula, O., May 31, 1893.

Sealed proposals will be received at the above mentioned office until noon, Saturday, July 1, 1893, for furnishing necessary labor and materials for constructing about 5,000 feet of sewer in West and Ohio streets, according to specifications on file in the office of the City Clerk.

Each bid must be accompanied by a sufficient guarantee of some disinterested person that if the bid is accepted a contract will be entered into and the performance of it properly secured. Bidders to use printed forms furnished on application.

The right is reserved to reject any or all bids.

By order of the Council.
24-1t A. B. PHILLIPS, Clerk.

NOTICE TO BRIDGE CONTRACTORS

Sealed proposals will be received by the undersigned, at the County Commissioners' office, Fairfield County Court House, at Bridgeport, Conn., until 10 a. m., of Thursday, June 29th, 1893, and then publicly opened, for furnishing all labor and material required in the construction of a pile foundation and masonry substructure, and the erection of an iron or steel superstructure (after design submitted by bidder) over the Housatonic River, between the counties of New Haven and Fairfield, on or near the site of the present bridge, known as Washington Bridge. The entire length of bridge will be six hundred and sixty (660) feet, and will consist of two fixed spans, each 230 feet in length, and a draw-span of 200 feet.

Only bids which contemplate the entire work, as named in the specifications, will be considered.

Plans, specifications, and any information desired, may be obtained at the office of Scofield & Starr, Room 2, City Hall, Bridgeport, Conn.

Each bid must be accompanied by a certified check, or its equivalent, for one thousand (1,000) dollars, payable to the undersigned, as Secretary of the Joint Board of County Commissioners, for the above named counties, as a guarantee that, in case the contract is awarded, the party or parties to whom the award is made, will, within five days after notification of award, execute said contract.

The Commissioners reserve the right to reject any or all bids.

By order of the joint Board of Commissioners for New Haven and Fairfield counties. DANIEL M. ROWLAND,
Secretary.

Bridgeport, June 8, 1893. 24-2t

NOTICE TO CONTRACTORS.

Office of the City Clerk,
Ashtabula, O., May 31, 1893.

Sealed proposals will be received at the above-mentioned office until noon, Saturday, July 1, 1893, for furnishing necessary labor and materials for constructing about 5,300 feet of sewer in West Prospect, Centre and Fisk streets, according to specifications on file in the office of the City Clerk.

Each bid must be accompanied by a sufficient guarantee that if the bid is accepted a contract will be entered into and the performance of it secured. Bidders to use printed forms furnished on application.

The right is reserved to reject any or all bids.

By order of the Council.
24-1t A. B. PHILLIPS, Clerk.

NOTICE TO SEWERAGE ENGINEERS.

Sealed proposals will be received by the Sewer Commissioners of the Village of Jamaica, Queens County, N. Y., until June 19th, 1893, at 8 o'clock, p. m., for a survey, necessary maps, plans, specifications and estimates for a system of sewerage in said village.

The commissioners reserve the right to reject any and all bids.

The present grade, map, etc., of the village can be examined by applying to Mr. J. Tyler Watts, president of said village.

Any further information can be obtained by applying to the undersigned.

A. A. DEGRAUN, President.
J. TYLER WATTS,
PHILIP M. WOOD,
EMILE VIENOT,
JOHN ADIKES,
Sewer Commissioners.
J. BROWNE, JR., Clerk. 24-1t

WATER WORKS—TOWN OF MEREDITH, N. H.

Sealed proposals will be received by the Water Commissioners of Meredith Village Fire District, in the town of Meredith, N. H., until 12 o'clock, noon, Thursday, June 30, 1893.

The work will consist of a reservoir of about 5,500,000 gallons capacity, covering about two and four-tenths (2 4-10) acres, and about five miles of pipe, varying in size from four (4) to ten (10) inches, requiring about 550 tons of cast iron pipe and special castings, together with about 30 gates and 33 hydrants.

The earthen dam will be about 300 feet long and about 26 feet high.

Proposals will be received for the above work, in whole or in part.

The contractor will state the time he will require to complete the work.

The Commissioners reserve the right to reject any or all proposals.

Specifications and plans can be seen upon application to the Water Commissioners at Meredith, N. H., or to Samuel M. Gray, Consulting Engineer, 20 Market Square, Providence, R. I. 24-3t

COMMONWEALTH OF MASSACHUSETTS.

METROPOLITAN SEWERAGE COMMISSIONERS.—NOTICE TO BUILDERS OF PUMPING ENGINES.

Sealed bids for the pumping plant for the pumping station at CHARLESTOWN will be received by the Board of Metropolitan Sewerage Commissioners at its office, 110 Boylston Street, Boston, Mass., until 12 o'clock m. of Saturday, July 1, 1893, and at that time will be publicly opened and read.

The Board will provide an engine-house, boiler-house, chimney and masonry foundations for the pumps, and will furnish a fresh water supply for the boilers up to the interior of the boiler-house. The contractor's bid must be for furnishing, setting up and completing, ready for use, two pumping engines (or sets of engines), two boilers, piping, and all necessary appliances and fittings, such as are to be found in pumping stations of the best class.

Each pumping engine must be capable of easily raising 35 cubic feet of sewage per second 11 feet vertically above the level of the sewage in its respective pump well. Each of the engines must also be capable of raising to greater lifts up to 30 feet, quantities of sewage inversely proportional to such lifts.

The contractors must provide at the station two steam boilers of such capacity that either of them can easily supply the necessary steam for the two engines when discharging together 70 cubic feet per second, with a lift of 11 feet.

The design of the pumping engines may be of any form which will fulfil the conditions named in the general specifications.

Each bid must be made on one of the blank forms furnished by the Board, and must be accompanied by a properly certified check for the sum of $1,000, the latter to be returned unless forfeited by abandonment of the proposal.

The Board reserves the right to reject any and all bids.

Plans, blank forms, general specifications and further information may be obtained at this office.

HOSEA KINGMAN,
TILLY HAYNES,
HARVEY N. COLLISON,
Board of Metropolitan Sewerage Commissioners of Massachusetts.
HOWARD A. CARSON,
19-8t Chief Engineer.

PROPOSALS FOR TELFORD ROAD IN NEW ROCHELLE.

Sealed proposals will be received by the Commissioners of Highway Improvements for the village of New Rochelle, N. Y., for paving with Telford pavement certain streets in said village, in all amounting from 30,000 to 35,000 square yards, on or before 5 p. m. on Monday, June 19th, 1893.

Plans and specifications may be seen at the office of De Luze & Emmett, C. E., at Post Office Building, New Rochelle, and at the office of James Owen, C. E., 800 Broad Street, Newark, N. J.

Each proposal to be accompanied with a certified check for five hundred dollars, payable to the Commissioners of Highway Improvements, and the same shall be forfeited to the Commissioners if the person or persons to whom the contract may be awarded shall neglect or refuse to execute the same within ten days after notification that his or their proposal has been accepted.

Proposals to be addressed to the Commissioners of Highway Improvements of New Rochelle, and will be received by the Village Clerk at his office, Corporation Rooms, New Rochelle.

The Commissioners reserve the right to reject any or all bids.

JOHN H. FERGUSON,
23-2t Village Clerk.

TOWN OF CICERO.

PROPOSALS FOR CAST IRON PIPE, ETC.

Sealed proposals in duplicate (said proposals to be addressed as follows: Original to the Town Clerk,—duplicate to the President of the Town to whom it must be delivered) are invited for furnishing and laying 6,550 feet of 10-inch cast iron water pipe, 24,900 feet of 8-inch cast iron water pipe, 56,100 feet of 6-inch cast iron water pipe, 20,300 feet of 4-inch cast iron water pipe, 4 10-inch valves, 21 8-inch valves, 51 6-inch valves, 29 4-inch valves; also, furnishing and laying 1,900 feet 4-inch cast iron water pipe, 3 4-inch valves, in the Town of Cicero, Cook Co., Ill., in accordance with the ordinances, profiles and specifications now on file in the Engineer's office.

Payment for said work to be made from special assessments when collected.

Bids will be received until 12 m., Friday, June 22d, 1893. A certified check for $1,500 must accompany the proposal marked original.

The Board of Trustees of the Town of Cicero reserve the right to reject any or all bids.

ED. S. AUSTIN,
Town Clerk.
Austin, Ill., May 16th, 1893. 21-4t

UTICA PIPE FOUNDRY CO.

CAST IRON PIPE AND SPECIALS FOR WATER AND GAS.

Also flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, etc. CHAS. MILLAR & SON, Selling Agents, Utica, N. Y. Manufacturers of Lead Pipe and Plumbers' Materials. Wholesale Eastern Agents Akron Vitrified Sewer Pipe.

JOHN W. HARRISON, Pres. and Treas. THOS. HOWARD, Vice-Pres.
F. B. NICHOLS, 2d Vice-Pres. E. H. QUEEN, Sec'y. P. MCARTHUR, Supt.

HOWARD-HARRISON IRON COMPANY,
MANUFACTURERS OF

CAST IRON PIPE

FOR WATER-WORKS, GAS WORKS, CULVERTS.
Pipe and Pump Connections. Flexible Joints. Heavy Loam Castings.
Works at BESSEMER, ALA. Offices at BESSEMER and ST. LOUIS.

ARTHUR KIRK & SON, PITTSBURGH, PA.

POWDER, DYNAMITE, ROCK DRILLS,
AIR COMPRESSORS, ROCK BREAKERS,
Safety Fuse, Electric Batteries, Miners' Squibs.

FOR Best Results USE THE WARREN FILTER,
—MANUFACTURED BY—
CUMBERLAND MFG. CO., Boston, Mass.

THE STANDARD CONSTRUCTION CO.,
GENERAL CONTRACTORS.
SEWER AND MASONRY BUILDING, STREET PAVING, ETC.
Main Office, Lewis Block, Pittsburg, Pa.

Smoothness of motion, absolute safety and high speed are among the good qualities possessed by
OTIS ELEVATORS.
They are built by Otis Brothers & Co., 38 Park Row, New York.

NOTICE TO WATER-WORKS CONTRACTORS.—The undersigned will, on Saturday, July 1, 1893, at the hour of 2 o'clock p. m., sell to the highest and best bidder, the franchise (20 years) or privilege of erecting and maintaining a system of water-works in the City of Cynthiana, Ky., according to plans and specifications now on file in my office.

Previous to, and at this time, I will receive sealed bids for supplying the City of Cynthiana, Ky., and inhabitants with water for a period of twenty (20) years.

For further particulars, plans and specifications, apply to the undersigned.

23-2t L. S. WILLIAMS, City Clerk.

PROPOSALS FOR PIPE SEWERS, ETC.

Sealed proposals will be received until 1 o'clock June 15, 1893, by the city council for the construction of sewers, consisting approximately of 4,239 feet of 12-inch pipe sewer and 1,900 feet of 15-inch pipe sewer, and about 100 6-inch house connections carried to the property line; also, 21 manholes, 8 lamp holes and 1 flush tank. As the number of house connections is indefinite, the bids will be expected to be per running foot for the house connections.

Plans and specifications can be examined at the office of the City Clerk and at the office of the City Engineer. Each bid to be accompanied with a certified check to the amount of 10 per cent. of the bid, payable to the order of Beth Vincent, City Treasurer. The council reserves the right to reject any and all bids. By order of the Sewer Committee.

C. P. HEPLER, Chairman.
Fort Dodge, Iowa, May 15, 1893. 21-4t

COLUMBUS SEWER PIPE CO.
COLUMBUS, OHIO.
Write for Prices.

Any company contemplating the expenditure of a large amount in the establishment of a manufacturing industry, requiring the use of a thoroughly equipped Machine shop, Boiler shop, Foundry and Smith shop plant, well located on competing trunk lines on railroads and in a good labor market, is invited to address Stimson, Williams & Co., Bryant Building, 55 Liberty street, New York city.

PROPOSALS FOR WATER-WORKS.

Sealed proposals will be received by the city of Dillon, Mont., until 8 p. m. of July 5th, 1893, for the material and labor incident to the construction of a system of water-works for the city, all proposals to be accompanied by a certified check to 10 per cent. of the amount of the bid. The city reserves the right to reject any or all bids. Plans and specifications can be seen at the office of the City Clerk in said city, or of Ray & Tingle, Engineers, Butte, Mont.

EDWIN NORRIS, City Clerk.
June 5, 1893. 24-2t

NEW COURT HOUSE.

NOTICE TO CONTRACTORS.

Sealed proposals will be received at the office of the Auditor of Auglaize county, Ohio, Saturday, June 24, 1893, until 2 o'clock, p. m., for the erection, building and construction of a court house in Wapakoneta, Auglaize county, Ohio.

The plans and specifications of said court house can be seen at the office of Kremer & Hart, architects, Columbus, O., and at the office of the Auditor of Auglaize county, O., on and after June 1st, 1893.

All bids will be for the completion of said court house in accordance with plans and specifications as prepared and provided and on file at the offices above named. All bids must be accompanied by a certified check for the sum of five hundred dollars ($500), as a guarantee that the successful bidder will enter into contract within ten (10) days after award is made. The commissioners reserve the right to reject any or all bids.

By order board of commissioners Auglaize county, O.

R. B. GORDON, JR., Auditor.
Wapakoneta, Ohio, May 24th, 1893.

NOTICE OF SALE AT PUBLIC AUCTION.

On June 26, 1893, at 3 o'Clock P. M.

DIAMOND DRILLS FOR SALE.

The Aqueduct Commissioners of the City of New York, under the direction of Abram Hyatt, Auctioneer, will sell at public auction, at the office of their engineer, at Sing Sing, N. Y., the following property:

Two No. 7 diamond drill engines, complete, with mandrels, casings, drill rods, couplings, core barrels and other fittings, etc. Also 1 20-horse power porable boiler and 1 12-horse-power portable boiler with tools and fittings for same.

For particulars and terms of sale see "City Record," published at No. 2 City Hall, New York City, or inquire of C. S. Gowen, Division Engineer, or Abram Hyatt, Auctioneer, at Sing Sing, N. Y.

By order of the Aqueduct Commissioners.
J. C. DUANE, President.
24-2t J. C. LULLEY, Secretary.

PROPOSALS FOR COVERED RESERVOIR.

Will be received by the village of Norwood, O., up to 12 o'clock noon of the 3d day of July, 1893, for a covered reservoir 40 feet in diameter, 60 feet high, and an open tank 20 feet in diameter, 15 feet high, including the steel or iron superstructures and the masonry foundations. Each bid must be made on the blank form furnished for the purpose. It must be accompanied by a certified check for $500, payable to the order of the water-works trustees. It must be addressed to the water-works trustees and marked "Proposal for Reservoir and Tank." If a bid is accepted, the check accompanying it is to be forfeited should the bidder fail to enter into a contract for the work or faithfully perform the same.

The right to reject any or all bids is specially reserved by the trustees.

Plans, specifications and forms of proposal can be seen at the office of the consulting engineer, G. Bouscaren, Mitchell Building, Cincinnati, O.

A. A. SPRINGER,
GEO. PUCHTA,
HENRY RIKHOFF,
24-1t Water-Works Trustees.

SEWERS IN BROADWAY AND FLUSHING PLACE, FLUSHING, N. Y.

Bids for furnishing and laying about 2,800 feet of cement sewer pipe, ranging in size from 24 ins. to 9 ins., will be received by the Board of Trustees of the Village of Flushing, at the Town Hall in said village, until 8 p. m. on the 26th day of June, 1893.

For specifications and information apply to the undersigned.

A certified check in the sum of five hundred (500) dollars must accompany each bid.

The right is reserved to reject any or all bids.

G. A. ROULLIER,
Engineer,
20 Main St., Flushing, L. I. 24-1t

PIPE SEWERS.

NORWICH, N. Y.

June 2, 1893.

NOTICE TO CONTRACTORS.

Sealed proposals for the construction of, approximately, ten (10) miles of PIPE SEWERS from 8 to 20-inch diameter, will be received by the Sewer Commission until 5 p. m. June 22, 1893.

Plans, profiles, requirements of proposals and specifications are on file in the office of the commission at Norwich, N. Y., and in the office of Carrol Ph. Bassett, engineer in charge, at Orange, N. J.

Certified check for $1,000 is required with each bid.

The Sewer Commission reserves the right to reject any and all bids.

WM. M. MASON,
Clerk.
C. PH. BASSETT, C. E. 24-1t

WATER-WORKS BONDS.

The City of Alliance, Nebraska, will accept sealed bids until June 21, 1893, for the sale of Seventeen **WATER-WORKS BONDS,** One Thousand Dollars each, bearing six per cent. per annum, principal and interest payable in New York. 24-1t

GUSTAVE EHRHARDT & SONS.

MACHINE TOOL WORKS.

MANUFACTURERS AND IMPORTERS OF

IMPROVED METAL WORKING MACHINES.

Branch of HEINR. EHRHARDT, Duesseldorf, Germany.

Cold Saws and Cold Sawing Machines

OF OUR OWN MAKE A SPECIALTY.

Machine Tools for Railway Shops, Bridge Builders, Steel and Iron Foundries, Steel Works, Rolling Mills, etc. Hydraulic Machinery and other Architectural Iron Works. Lathes for special purposes, Presses f r Corrugated Iron, Straightening Machines, Milling and Grinding Machines.

Machines can be seen in operation at our Works, HOMEWOOD STATION, P. R. R., near Pittsburg, and also at the CHICAGO EXPOSITION.

Catalogues Furnished on Application. Send for Prices and Discounts.

PROPOSALS FOR CONSTRUCTION OF DAMS AND SHORE PROTECTIONS ON UPPER MISSISSIPPI RIVER, AND FOR FURNISHING ROCK AND BRUSH ON UNITED STATES BARGES.—U. S. Engineer Office, Rock Island, Ill., June 3, 1893.—Sealed proposals will be received at this office until two o'clock p. m. on the 6th day of July, 1893, and then publicly opened, for: 1. Furnishing thirty thousand (30,000) cubic yards of brush between St. Paul and Lake Pepin. 2. Furnishing ten thousand (10,000) cubic yards of rip-rap rock between St. Paul and Lake Pepin. 3. Construction of shore protections between Smith's Bar and Lake Pepin. 4. Furnishing twenty-five thousand (25,000) cubic yards of brush between Fountain City and Genoa, Wisconsin. 5. Furnishing ten thousand (10,000) cubic yards of rip-rap rock between Fountain City, Wis., and Brownsville, Minn. 6. Construction of dams and shore protections between Genoa and Prairie du Chien, Wis. 7. Construction of dams and shore protections between Dubuque and Clinton, Iowa. 8. Furnishing thirty thousand (30,000) cubic yards of brush between Keithsburg, Ill., and Montrose, Iowa. 9. Furnishing twenty-five thousand (25,000) cubic yards of rip-rap rock between Keithsburg, Ill., and Montrose, Iowa. 10. Furnishing twenty thousand (20,000) cubic yards of brush between Quincy Bridge and Clarksville, Mo. 11. Furnishing fifteen thousand (15,000) cubic yards rip-rap rock between Hannibal and Clarksville, Mo. 12. Construction of dams and shore protections between Clarksville, Mo., and Hamburg, Ill. 13. Construction of dams and shore protections between Hamburg, Ill., and Cap au Gris, Mo. 14. Construction of dams and shore protections between Cap au Gris, Mo., and mouth of the Illinois River. 15. Furnishing fifty thousand (50,000) cubic yards of brush within twenty-five miles of Piasa Island. Specifications, blank forms, and all available information will be furnished on application to this office. 23-4t

U. S. ENGINEER OFFICE, MOBILE, Ala., May 25, 1893.—To whom it may concern: Whereas, the navigation of Mobile River, Ala., at the city of Mobile is obstructed and endangered by a sunken drydock, lying near the foot of Elmira Street, Mobile, Ala., notice is hereby given to all persons interested in said drydock that, if within thirty (30) days from the date of the advertisement, they shall not have signified to me their intention, and taken preliminary steps to remove said drydock as soon as practicable, the same will be considered as abandoned and derelict, and it will be removed by the United States under authority of law. Sealed proposals, in duplicate, for the removal of said dry dock will be received at this office until 12 o'clock, noon, on June 26, 1893, and then opened. The United States reserves the right to reject any and all proposals, and to waive any informalities. Full information furnished upon application to this office. By authority of the Secretary of War. A. N. Damrell, Major of Engineers U. S. A. 22-4t

TREASURY DEPARTMENT, OFFICE Supervising Architect, Washington, D. C., May 29, 1893.—Sealed proposals will be received at this office until 2 o'clock p. m., on the 27th day of June, 1893, and opened immediately thereafter, for all the labor and materials, and fixing in place complete a heating and ventilating apparatus in the following named public buildings: Ashland, Wis.; Atchison, Kan.; Beatrice, Neb.; Danville, Ill.; Fremont, Neb.; Lansing, Mich.; La Fayette, Ind., and San Jose, Cal., in accordance with the drawings and specification, copies of which may be had at this office or the office of the Superintendent at each building. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The right is reserved to reject any and all bids and to waive any defect or informality in any bid, if it be deemed in the interest of the Government to do so. All proposals received after the time stated will be returned to the bidders. Proposals must be inclosed in envelopes, sealed and marked "Proposal for the Heating and Ventilating Apparatus for the U. S. Post Office Building at Ashland, Wisconsin," or otherwise, as the case may be, and addressed to JEREMIAH O'ROURKE, Supervising Architect. 23-2t

U. S. ENGINEER OFFICE, MONTGOMERY, Ala., May 25th, 1893.—Sealed proposals in triplicate, for furnishing machinery for a concrete mixing and distributing plant, at Wetumpka, Ala., will be received at this office until 12 o'clock, noon, June 24th, 1893, and then publicly opened. Specifications, blank forms, and all available information will be furnished on application to this office. PHILIP M. PRICE, Captain, Corps of Engineers, U. S. A. 21-4t

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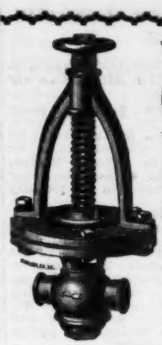

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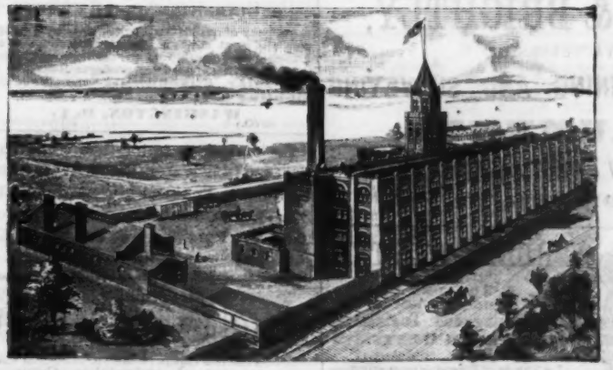

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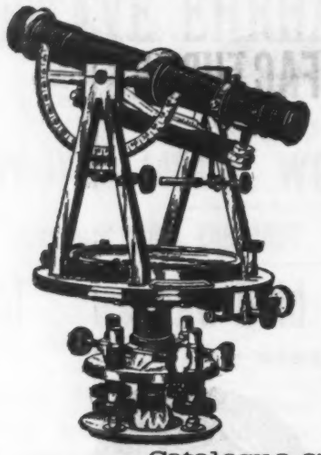

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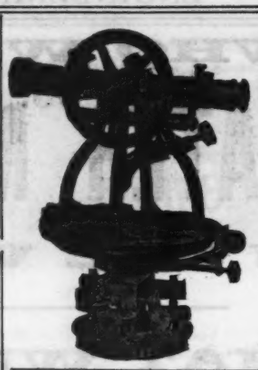

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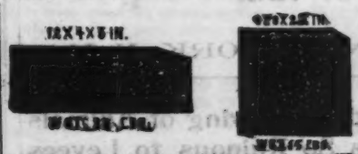

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